THE MARINE REVIEW

VOL. 41 CLEVELAND JANUARY, 1911 NEW YORK No. 1

SHIP BUILDING ON THE LAKES

THE ship yards of the great lakes have eighteen vessels under construction for 1911 delivery, including five bulk freighters, one car ferry, two passenger steamers, one excursion steamer, two oil tenders, one fuel lighter, one car float, two light-house tenders, two light vessels, and one quarantine steamer. Of this program the American Ship Building Co. is building eight, the Great Lakes Engineering Works one, the Manitowoc Dry Dock Co. one, the Racine Boat Mfg. Co. three, the Collingwood Ship Building Co. four and the Kingston Ship Building Co. one. Car ferry Ann Arbor No. 5 was delivered to the Ann Arbor railroad by the Toledo Ship Building Co. on Jan. 1, so that she is stricken from the constructive list, though she properly belongs in the 1911 delivery program.

Again subdividing the program, the American Ship Building Co.'s program consists of three bulk freighters, one car ferry, one excursion steamer, two oil tankers, and one fuel lighter. Of this program car ferry Pere Marquette 18, building for the Pere Marquette Railroad, has already been launched. The Great Lakes Engineering Works has also launched the freighter Willis L. King, which it is building for the Jones & Laughlin Steel Co. The Manitowoc Dry Dock Co. is building a car float. The Racine Boat Manufacturing Co. is building two light vessels and a light-house tender. The tender, named Camellia, has already been launched. The Collingwood Ship Building Co. is building one bulk freighter, two passenger steamers and one light-house tender. The bulk freighter, the Emperor, building for the Inland Navigation Co., has been launched. The Kingston Ship Building Co. is building a quarantine steamer.

The Collingwood Ship Building Co. also has a contract to lengthen the steamer Alberta, of the Canadian Pacific Railway Co.'s fleet, by 42 ft.

Excluding Canadian tonnage the four bulk freighters included in this program will have a carrying capacity of 43,000 gross tons of ore in a single trip, or 460,000 gross tons in an average season of 20 trips. It will be observed in the launching program published elsewhere in this issue that twenty bulk freighters were launched in 1910, having a carrying capacity of 194,500 gross tons in a single trip, or 3,890,000 gross tons in an average season of 20 trips. In the past nine years bulk freighters having a carrying capacity of 41,088,000 gross tons of ore have been added to the lake fleet. The 1911 program as so far announced will increase this to 41,548,000 tons. This is practically equivalent to the movement of ores during 1909 and 1910. Moreover it is generally known that additional contracts are pending. For instance the Pittsburg Steamship Co. has been authorized by the United States Steel Corporation to build two 600-footers and it is likely that Mr. Coulby, president and general manager of the company, will let the contracts in the near future. W. P. Snyder, of Pittsburg, has also had plans drawn for an addition to his fleet in the shape of two 615-footers, though probably not more than one of them will be built for 1911 delivery. It is an interesting commentary that not a single bulk freighter is building for independent interests. They are all for interests identified with iron and steel making. Apparently the independent owner desires that the business shall absorb the present tonnage before he adds to it. The surplus of ships was quite acute during 1910.

Altogether 51 vessels were launched on the great lakes during 1910, exclusive of Canadian tonnage. The last included 20 bulk freighters, three package freighters, two passengers, one steamer, three car. ferries, one river ferry, one lumber steamer, 12 tugs, three lighters, one light-house tender, one sand sucker, two dump scows and two gold dredges.

The ship yards have on hand a number of vessels undergoing repairs, some of them of an extensive character, especially those that are being altered to the arch system of construction so that the ship yards at least are assured of a profitable winter.

VESSELS UNDER CONSTRUCTION IN GREAT LAKES SHIP YARDS FOR 1911 DELIVERY.

AMERICAN SHIP BUILDING CO.'S YARDS.

To be built at	Type or name.	Dimensions in ft. Over all.	Keel.	Beam.	Depth.	Dimensions of engines.	Boilers, dimensions in ft. and in.	Draught.	Steam pressure, lbs.	Capacity, gross tons.	For whom building.
Lorain......	Ftr.	552	532	58	31	23½, 38, 63 x 42	3 Scotch 12.6 x 11.6	Ellis & Eaves	180	10,000	Buffalo & Susquehanna Steamship Co., Capt. John Mitchell, mgr., Cleveland, O.
Lorain......	*Ftr.	524	504	54	30	23½, 38, 63 x 42	14.6 x 11.6	Ellis & Eaves	180	9,000	M. A. Hanna & Co., mgrs., Cleveland, O.
Chicago.....	Car ferry P. M. 18.	350	338	56	19½	19, 31, 52 x 36	4 Scotch 13.9 x 11.6	Natural	175	30 cars	Pere Marquette R. R., Detroit, Mich.
Wyandotte..	Pass. Str.	240	227	46	17.3	25, 40, 45, 45 x 36	4 Scotch 12.6 x 10.6	Howden	180	....	Ashley & Dustin, Detroit, Mich.
Lorain......	Ftr.	600	580	58	32	24, 39, 65 x 42	2 Scotch 16 x 11.6	Ellis & Eaves	170	12,000	Jones & Laughlin Steel Co., Pittsburg, Pa.
Cleveland...	Oil Str.	260	250	43	23	19, 31, 54 x 42	2 Scotch 14.6 x 11.6	Natural	200	800,000 gal.	Standard Oil Co.
Cleveland...	Oil Bge.	260	250	43	23	————	11.6 x 11.6	....	130	1,000,000 gal.	Standard Oil Co.
Buffalo.....	Fuel Ltr.	164	164	40	21.9	Two 18 x 20	12 x 12	....	150	....	Pittsburg Coal Co., Cleveland, O.

GREAT LAKES ENGINEERING WORKS, DETROIT, MICH.

To be built at	Type or name.	Over all.	Keel.	Beam.	Depth.	Dimensions of engines.	Boilers.	Draught.	Steam pressure, lbs.	Capacity, gross tons.	For whom building.
Ecorse......	Ftr. Willis L. King.	600	580	58	32	24, 38, 65 x 42	16 x 12.2	Forced	170	12,000	Jones & Laughlin Steel Co., Pittsburg, Pa.

MANITOWOC SHIP BUILDING & DRY DOCK CO., MANITOWOC, WIS.*

To be built at	Type or name.	Over all.	Keel.	Beam.	Depth.	Dimensions of engines.	Boilers.	Draught.	Steam pressure, lbs.	Capacity, gross tons.	For whom building.
Manitowoc..	Car float	190	..	36	8	No power	....	....	.....	....	Chicago River & Indiana R. R. Co.

RACINE BOAT MANUFACTURING CO., MUSKEGON, MICH.

To be built at	Type or name.	Over all.	Keel.	Beam.	Depth.	Dimensions of engines.	Boilers.	Draught.	Steam pressure, lbs.	Capacity, gross tons.	For whom building.
Muskegon...	Light Vessel No. 82.	105	89	21	14	14 x 14	5′ x 9′ 6″ firebox	Natural	110	180	Light House Bureau.
Muskegon...	Light Vessel No. 95.	120	105	24	16	18 x 20	2 Scotch 9.6 x 10	Natural	110	330	Light House Bureau.
Muskegon...	Lighthouse Tender Camellia.	139	118	24	12	Two 8, 13, 21 x 16	Two water-tube	Natural	225	220	Light House Bureau.

COLLINGWOOD SHIP BUILDING CO., LTD., COLLINGWOOD, ONT.

To be built at	Type or name.	Over all.	Keel.	Beam.	Depth.	Dimensions of engines.	Boilers.	Draught.	Steam pressure, lbs.	Capacity, gross tons.	For whom building.
Collingwood.	Ftr. Emperor	525	504	56	31	23, 38½, 63 x 42	2 Scotch 15.6 x 12	Natural	180	9,000	Inland Navigation Co., Ltd., Midland, Ont.
Collingwood.	Pass. and Frt. Str.	210	200	42.6	11.6	12½, 18, 26, 40 x 18	Two 2 Scotch 12.6 x 11	Howden	250	....	Ontario & Quebec Nav. Co., Ltd., Picton, Ont.
Collingwood.	Pass. and Frt. Str.	200.10½	193	38.8	13.9	18, 29, 48 x 30	2 Scotch 13.6 x 11	Natural	180	....	Niagara, St. Catherines & Toronto Nav. Co., Ltd., St. Catherines, Ont.
Collingwood.	Lighthouse Tender Estevan.	212	200	38	17.6	Two 15, 25, 42 x 25	2 Scotch 13.6 x 10.6	Howden	180	....	Canadian Government.

KINGSTON SHIP BUILDING CO., LTD., KINGSTON, ONT.

To be built at	Type or name.	Over all.	Keel.	Beam.	Depth.	Dimensions of engines.	Boilers.	Draught.	Steam pressure, lbs.	Capacity, gross tons.	For whom building.
Kingston....	Quarantine Str.	113.3	103.3	23	12.6	18 and 36 x 24	13.6 x 11	....	130	....	Public Health Branch, Dominion Dept. of Agriculture of Canada.

*Isherwood system of construction.

Ship Yard Notes

The Dubuque Boat & Boiler Works, Dubuque, Iowa, was the lowest bidder for the construction of three steel tow boats for the Mississippi River Improvement Commission, to be delivered at Gasconade, Mo. The boats are to be 136 ft. long and 24 ft. beam and the approximate cost of the three is $110,000.

A number of vessels will be overhauled and repaired at the ship yard of A. P. Kenyon, Marine City, Mich., during the winter.

The Kingston Ship Building Co., Ltd., Kingston, Ont., is building a small boat of the alligator type for the Upper Ottawa Improvement Co., Ottawa, to be 50 ft. long, 16 ft. 6 in. in breadth and 4 ft. 6 in. deep, for portaging purposes. The company reports having considerable work on hand for the winter, both in dock and outside.

Edward Ramage, 267 Wellington street, West, Toronto, Ont., is building a tug 20 ft. beam, twin screw, steel decks and upper works, for the Clark Co., Toronto, Ont.

The passenger and freight steamer Alberta, belonging to the fleet of the Canadian Pacific Railway Co., Montreal, will be lengthened 42 ft. at the yard of the Collingwood Ship Building Co., Ltd., Collingwood, Ont. during the winter, making the steamer 312 ft. long over all, 296 ft. keel, 38 ft. 2 in. beam and 24 ft. deep.

The bulk freighter Hoover & Mason, of the Tomlinson fleet, is having her water-tube boilers removed and Scotch boilers installed in their place, at the plant of the Great Lakes Engineering Works, Detroit.

A combination oil and cargo barge, the first of its kind ever built in Portland, was recently launched by the Willamette Iron & Steel Works. The barge is designed to carry 550 tons of cargo on deck and 3,000 barrels of oil in her hold, which is divided into eight oil-tight compartments with sluice gates connecting the different compartments. The barge is 130 ft. long, 30 ft. beam and 5.6 ft. depth of hold. She is owned by the Western Towing & Transportation Co.

The steamer Damara, which went on the rocks while leaving San Francisco harbor about two months ago, is being converted into an oil burner at the plant of the Union Iron Works, which purchased the vessel from Captain William Matson, who, in turn had purchased her from Lloyds, after the owners of the vessel abandoned her. More than 200 men are at work on the repairs and the steamer is expected to be ready for sea by Feb. 1.

MERCHANT WORK IN COAST YARDS

William Cramp & Sons Ship & Engine Building Co., Philadelphia, Pa.

Two steel car floats for the Delaware, Lackawanna & Western Railroad Co., 268 ft. over all.

Steel oil barge, 96 ft. over all, for Guffey Petroleum Co.; to be fitted with gas engines built by Standard Motor Construction Co.; 150 H. P.

Steel steam cruiser for Cuban government, 260 ft. over all, 2,055 gross tons; twin screw reciprocating engines, 3,500 H. P.

Combination schooner ship and gunboat, steel, for Cuban government; 185 ft. over all, 1,200 gross tons; twin screw reciprocating engines, 1,200 H. P.

Two steel car floats for the Pennsylvania Railroad Co., 250 ft. over all.

Newport News Shipbuilding & Dry Dock Co., Newport News, Va.

Freight and passenger steamer Madison, 372 ft. long, triple-expansion, four Scotch boilers, for Old Dominion Steamship Co., New York.

Oil tank, W. F. Herrin, 400 ft., triple-expansion, four Scotch boilers, Associated Oil Co., San Francisco, Cal.

Freight steamer Corozal, 347 ft. long, triple-expansion, three Scotch boilers, New York & Porto Rico Steamship Co., New York.

Freight steamer, Montoso, 347 ft., triple-expansion, three Scotch boilers, New York & Porto Rico Steamship Co., New York.

Freight steamer, unnamed, 347 ft., triple-expansion engines, Scotch boilers, for New York & Porto Rico Steamship Co., New York.

Maryland Steel Co., Sparrows Point, Md.

Bay steel passenger steamer City of Baltimore, 310 ft., triple-expansion engines, four Scotch boilers, for Chesapeake Steamship Co., Baltimore, Md.

Bay steel passenger steamer City of Norfolk, 310 ft. long, triple-expansion, Scotch boilers, for Chesapeake Steamship Co., Baltimore, Md.

Pusey-Jones Co., Wilmington, Del.

Steel motor yacht Alacrity, 118 ft. long, 6-cylinder Craig motor for W. A. Bradford, New York City.

Steel motor yacht Joyeuse, 98 ft. long, Standard 6-cylinder motor, Henry W. Savage, New York City.

Steel tug, No. 35, 118 ft. long, triple-expansion engine, for Pennsylvania railroad.

The Moran Co., Seattle, Wash.

Steel passenger steamer Sioux, 157 ft. long, four-cylinder, triple-expansion, two Seabury water-tube boilers, for Puget Sound Navigation Co., Seattle, Wash.

Union Iron Works, San Francisco, Cal.

Steel paddle ferry steamer San Pedro, 259 ft. long, compound engine, four Babcock & Wilcox boilers, for Atchison, Topeka & Santa Fe railway.

Craig Ship Building Co., Long Beach, Cal.

Steamer General Hubbard, 268 ft. long, triple-expansion engine and three Scotch boilers, for Hammond Lumber Co., San Francisco.

Steamer Navajo, 268 ft. long, triple-expansion engine and three Scotch boilers, for Western Steam Navigation Co., San Francisco.

Southern Pacific Co., West Oakland, Cal.

Stern wheel wooden steamer Seminole, 219 ft. long, duplex tandem compound engine and locomotive fire-box boiler, for Southern Pacific Co., San Francisco, Cal.

Side wheel wooden steamer Thoroughfare, 273 ft. long, duplex tandem compound engine, four Scotch boilers, for Southern Pacific Co., San Francisco, Cal.

Staten Island Shipbuilding Co., Port Richmond, S. I., N. Y.

Steel tug, 105 ft. over all, 400 gross tons, for stock; compound engine, 18 x 38 x 26; 840 H. P.

Steel ferry boat Wildwood, 168 ft. over all, 800 gross tons, for Pennsylvania Railroad Co.; three cylinder compound engine, 18-26-26 x 22.

Steel schooner yacht Karina, 198 ft. 6 in. over all, 1,600 gross tons, for R. E. Tod, New York.

Wooden tug, 100 ft. over all, for Erie Railroad Co.; compound engine, 18-38 x 26.

Steel tug P. R. R. No. 1, 86 ft. over all, 300 gross tons, for Pennsylvania Railroad Co.; compound engine, 17-34 x 24.

Steel tug, 95 ft. over all, 350 gross tons, for East Jersey Railroad & Terminal Co.; compound engine, 16-32 x 24.

Bath Iron Works, Bath, Me.

Steel passenger steamer 196 ft. over all for Maine Central Railroad, Portland, Me. Twin-screw engine, cylinders 16 in. x 26 in. x (2) 30 in.-24 in.; four Normand boilers; estimated gross tonnage, 725; estimated horsepower, 2,200.

Hartford & New York Transportation Co., Hartford, Conn.

Wooden coal barge for company's own use, 147 ft. long, 514 gross tons. Approximate value, $15,000.

Bath Marine Construction Co., Bath, Me.

Wooden gasoline boat, 55 ft. over all, for J. K. Robinson Jr., New York City; four-cylinder Standard engine, 32 H. P.; approximate value, $7,000.

Johnson Iron Works, Ltd., Julia and Water Streets, New Orleans, La.

Stern wheel steamboat for Mexican owners, 107 ft. over all, 100 gross tons; approximate value, $23,000; horizontal tandem compound engine, one fire box boiler, 75 H. P. Stern wheel steamboat for Mississippi River Commission, 137 ft. over all, 200 gross tons; approximate value, $39,000; horizontal tandem compound engine, three return tubular boilers, 150 H. P.

Read Bros., Fall River, Mass.

Wooden vessel, 25 ft. over all, for Capt. J. W. Hammond, Taunton, Mass.; gasoline engine, 8 H. P.; approximate value, $800.

Frederick S. Nock, East Greenwich, R. I.

Gasoline boat for W. C. Rhode, Providence, R. I., 20 ft. over all; approximate value, $800; 7½ H. P. Buffalo double cycle engine.

One gasoline launch, 36 ft. over all, for C. G. Washburn, Worcester, Mass., one 10 H. P. 2-stroke Hartford engine; value, $3,500.

One gasoline launch, 42 ft. over all, for H. S. Bullock, 4-6 White street, New York; one 30 H. P. Lamb 3-cycle engine; value, $3,800.

Rebuilding the "Yankee," 49 ft. over all, for M. L. Carter, Attleboro, Mass.; one 45-65 H. P. Sterling 6-cycle engine; value, $7,000.

Moore & Scott Iron Works, San Francisco, Cal.

Steel oil carrying barge, 200 ft. long, compound engines, for the Associated Oil Co., of San Francisco.

George C. Walker, Toledo, Ore.

Auxiliary fishing schooner, 50 ft. long, Imperial gas engine, for Hugh Corgan, Toledo, Ore.

Three barges, 52 ft. long, for Simon Lindton, Newport, Ore.

Fish boat, 24 ft. long, with auxiliary gas engine, for J. Booth, Toledo, Ore.

Tow boat, 19 ft. long, Imperial gas engine, for Modern Improvement Co., Toledo, Ore.

The New Burrell-Johnson Iron Co., Yarmouth, N. S.

Building engines for the following steamers: Le Blanc, Delbert D., Margaretville and Linden.

Dubuque Boat & Boiler Works, Dubuque, Ia.

Three tow boats, Guerney, Augustine and Lewis, 136 ft. long, cross compound stern wheel for United States Engineer Corps, Kansas City, Mo.

The F. W. Pickels Co., Annapolis Royal, N. S.

Wooden stern schooner, F. C. Lockhart, 125 ft. long for own use.

Joseph Supple, Foot of Belmont St., Portland, Ore.

Wharf boat for the State Portage railway at Celilo, Columbia river.

Wilbur A. Morse, Friendship, Me.

One 42 ft. sloop, one 30 ft. sloop yacht.

Fillmore A. Baker, Patchogue, N. Y.

Three 36-ft. hunting cabin gasoline launches and one open 30 ft. launch.

Murray & Tregurtha Co., South Boston, Mass.

Wooden cabin cruiser, 36½ ft. long, Muray & Tregurtha, 2-cylinder engine for Capt. McMilan, Winthrop, Mass.

Raised deck wooden cruiser, 86 ft. long, two 6-cylinder Murray & Tregurtha engines, W. S. Kilmer, New York.

Wooden cabin cruiser, 53 ft. long, one 4-cylinder Murray & Tregurtha engine for E. B. Holms, Boston, Mass.

W. G. Abbott, Milford, Del.

Fishing steamer, 140 ft. over all, 21 ft. beam and 11 ft. deep.

George H. Miller & Co., Patchogue, N. Y.

Power boat, 60 ft., 65 horsepower Standard motor, for Capt. Henry Wright, East Rockaway.

Stanley C. Vansant, Atlantic City.

Sailing yacht, 50 ft. long, for Capt. Benjamin Sooz, of Atlantic City.

Clooney Construction & Towing Co., Westlake, La.

Five lighters for delivery at Havana and five at Galveston.

LAKE LAUNCHINGS DURING 1910

DURING 1910, exclusive of Canadian yards, lake ship yards launched 51 vessels, of which 20 were bulk freighters, three package freighters, two passenger steamers, three car ferries, one river ferry, one lumber steamer, 12 tugs, three lighters, one lighthouse tender, one sand sucker, two dump scows, and two gold dredges. Of this program the American Ship Building Co. launched 24, of which 10 were bulk freighters, one passenger boat, six tugs, three package freighters, two car ferries, one river ferry and one lighter. The Great Lakes Engineering Works launched nine bulk freighters; the Toledo Ship Building Co. one lumber steamer; the Manitowoc Dry Dock Co. two lighters, one sand sucker and two dump scows; the Racine Boat Mfg. Co., one lighthouse tender; Johnston Bros. five fish tugs and two gold dredges; and Robert Curr, at Cleveland, built and launched a tug from Murphy & Donnelly's boiler shop.

The 20 bulk freighters have a carrying capacity of 194,500 gross tons in a single trip, or 3,890,000 gross tons in an average season of 20 trips.

During 1909, the lake ship yards, exclusive of Canadian yard, launched 39 vessels, of which 17 were bulk freighters, five were package freighters, five passenger steamers, six tugs, five lighters and one survey boat.

During 1908, exclusive of Canadian yards, lake ship yards launched 39 vessels, of which 24 were bulk freighters, two passenger boats, one package freighter, one Canadian canal freighter, three tugs, 3 fire boats, one lightship, two drill boats, one sand sucker and one supply boat.

These 24 bulk freighters have a carrying capacity of 101,400 tons on a single trip, or 2,028,000 tons in an average season.

During 1907 the lake ship yards, exclusive of Canadian yards, launched 56 vessels, of which 40 were bulk freighters, three package freighters, one passenger steamer, one wrecker, one lighter, one mail boat, five tugs and four scows. These 40 bulk freighters have a carrying capacity of 368,000 gross tons on a single trip. However, as one of the new steamers, the Cyprus, sank on her second trip, the net addition of that year was 361,000, or 7,220,000 tons in an average season.

During 1906, the ship builders of the great lakes, exclusive of the Canadian yards, launched 47 vessels, of which 40 were bulk freighters, two passenger steamers, two package freighters, two car ferries and one sand dredge. The 40 bulk freighters have a carrying capacity of 381,000 tons on a single trip, or 7,620,000 gross tons in an average season of 20 trips.

During 1905 the ship builders of the great lakes launched 32 steamers, of which 29 were bulk freighters, two package freighters and one car ferry. These 29 bulk freighters have 260,200 gross tons carrying capacity on a single trip, or 5,204,000 gross tons in an average season of 20 trips.

During 1904 lake ship yards launched 13 vessels, of which seven were bulk freighters, two package freighters, one car ferry and three passenger steamers. The seven bulk freighters have a carrying capacity of 51,300 tons on a single trip, or 1,026,000 in an average season of 20 trips.

During 1903 lake ship yards launched 50 vessels, of which 42 were bulk freighters, five car ferries and three passenger steamers. These 42 bulk freighters have a carrying capacity of 213,250 tons on a single trip or 4,265,000 tons in an average season of 20 trips. It should be stated, however, that ten of the freighters were built by Mr. Wolvin for St. Lawrence river trade and are actively engaged in that service, but as they are available for the ore trade, they have been classed as bulk freighters with an average capacity of 3,000 tons each on 18-ft. draught.

During 1902, the lake ship yards launched 42 vessels, of which 32 were bulk freighters, two car ferries and two vessels for salt water service. These 32 bulk freighters have a carry-

ing capacity of 171,910 tons on a single trip, or 3,438,200 tons in an average season of 20 trips. The particulars of vessels launched during 1909 will be found in the accompanying tables:

WHERE BUILT.	TYPE.	NAME OF VESSEL.	LENGTH OVER ALL	CARRYING CAPACITY, GROSS TONS	NAME AND ADDRESS OF OWNER.
AMERICAN SHIP BUILDING CO., CLEVELAND, O.					
Cleveland	Freighter	Leonard B. Miller	524	9,000	Miller Transit Co., Capt. W. C. Richardson, Cleveland, manager.
Lorain	Freighter	John P. Reiss	524	9,000	Wisconsin Transit Co., Sheboygan, Wis.
Lorain	Freighter	John B. Cowle	545	10,000	Standard Transp. Co., U. S. Transp. Co., Cleveland, mgrs.
Buffalo	Excursion Str	Canadiana	216	......	Lake Erie Excursion Co., Buffalo, N. Y.
Lorain	Freighter	Charles L. Hutchinson	564	10,000	Henry Wineman Jr., Detroit, Mich.
Wyandotte	Pkg. Frtr	Arlington	257	3,000	Rutland Transit Co., Ogdensburg, N. Y.
Wyandotte	Pkg. Frtr	Brandon	257	3,000	Rutland Transit Co., Ogdensburg, N. Y.
Buffalo	Ferry Str	Niagara Frontier	131	......	International Ferry Co., Buffalo, N. Y.
Lorain	Freighter	Joseph Wood	524	9,000	M. A. Hanna & Co., Cleveland, O.
Cleveland	Freighter	A. M. Byers	524	9,000	North American Steamship Co., R. A. Williams, Cleveland, manager.
Superior	Freighter	Peter Reiss	524	9,000	North American Steamship Co., R. A. Williams, Cleveland, manager.
Lorain	Freighter	Charles S. Price	524	9,000	Mahoning Steamship Co., M. A. Hanna & Co., Cleveland, managers.
Wyandotte	Freighter	E. H. Utley	524	9,000	Franklin Steamship Co., Duluth. H. K. Oakes, manager, Detroit, Mich.
Lorain	Fire tug	Torrent	120	......	Duluth & Iron Range Ry., Duluth, Minn.
Lorain	Fish tug	Cincinnati	70	......	Booth Fisheries Co., Chicago.
Lorain	Fish tug	Louisville	70	......	Booth Fisheries Co., Chicago.
Lorain	Fish tug	Chattanooga	70	......	Booth Fisheries Co., Chicago.
Lorain	Fish tug	Nashville	70	......	Booth Fisheries Co., Chicago.
Cleveland	Tug	E. P. Dempsey	87	......	Kelley Island Lime & Transport Co., Cleveland, O.
Wyandotte	Pkg. Frtr	Allegheny	372	5,000	Erie & Western Transportation Co., Buffalo, N. Y.
Buffalo	Fuel lighter	— — ——	168	......	Pickands, Mather & Co., Cleveland.
Lorain	Freighter	W. C. Moreland	600	12,000	Jones & Laughlin Steel Co., Pittsburg; W. H. Becker, manager, Cleveland.
Cleveland	Carferry	Marquette & Bessemer No. 2	350	30 cars	Marquette & Bessemer Dock & Navigation Co., Walkerville, Ont.
Chicago	Carferry	Pere Marquette 18	350	30 cars	Pere Marquette Railroad Co., Detroit, Mich.
GREAT LAKES ENGINEERING WORKS, DETROIT, MICH.					
Ecorse	Freighter	Ontario	465	7,500	Northern Lakes S. S. Co., Cleveland.
Ecorse	Freighter	Champlain	465	7,500	Northern Lakes S. S. Co., Cleveland.
St. Clair	Freighter	Harry E. Yates	550	10,000	American Steamship Co., Boland & Cornelius, managers, Buffalo.
Ecorse	Freighter	St. Clair	465	7,500	Northern Lakes S. S. Co., Cleveland.
St. Clair	Freighter	Theo. H. Wickwire Jr.	550	10,000	American Steamship Co., Boland & Cornelius, managers, Buffalo.
Ecorse	Freighter	W. L. Olcott	605	12,000	Pittsburg Steamship Co., Cleveland.
Ecorse	Freighter	William B. Dickson	605	12,000	Pittsburg Steamship Co., Cleveland.
Ecorse	Freighter	William P. Palmer	600	12,000	Pittsburg Steamship Co., Cleveland.
Ecorse	Freighter	Willis L. King	600	12,000	Jones & Laughlin, Pittsburg, Pa.
TOLEDO SHIP BUILDING CO., TOLEDO, O.					
Toledo	Freighter	Norway	524	9,000	U. S. Transportation Co., Cleveland.
Toledo	Pass. Str	Saint Claire	200	3,600 pass.	Detroit, Belle Isle & Windsor Ferry Co., Detroit, Mich.
Toledo	Lbr. Str	Erwin L. Fisher	237	2,249	Argo Steamship Co., Cleveland.
Toledo	Carferry	Ann Arbor No. 5	378	......	Ann Arbor Railroad & Steamship Lines, Detroit, Mich.
MANITOWOC SHIP BUILDING & DRY DOCK CO., MANITOWOC, WIS.					
Manitowoc	Lighter	Adele	140	......	Western Transit Co., Duluth, Minn.
Manitowoc	Sandsucker	M. G. Hausler	164	1,000	Lake Sand Co., Chicago, Ill.
Manitowoc	Dump scow	— —— —	144	600 yd.	Great Lakes Dredge & Dock Co., Chicago, Ill.
Manitowoc	Dump scow	— —	144	600 yd.	Great Lakes Dredge & Dock Co., Chicago, Ill.
Manitowoc	Lighter	Harvester	90	......	International Harvester Co., Chicago, Ill.
RACINE BOAT MFG. CO., MUSKEGON, MICH.					
Muskegon	Lighthouse tender	Camellia	116	230	Light House Department.
JOHNSTON BROS., FERRYSBURG, MICH.					
Ferrysburg	Fish tug	A. Fisher	80	......	A. Fisher's Sons, Grand Haven, Mich.
Ferrysburg	Tug	Shearwater	87	......	U. S. Fish Commission, Cleveland, O.
Ferrysburg	Tug	John E. Meyer	91	......	Barnett & Record, Duluth, Minn.
Ferrysburg	Gold dredge	No. 42	105	......	Boston & Oroville, California. (Exported to South America.)
Ferrysburg	Gold dredge	No. 43	95	......	S. A. Mower, Rangoon. (Exported to Burmah, India.)
Ferrysburg	Fish tug	Harvey	82	......	E. Schneidewind & Son, Sheboygan, Wis.
Ferrysburg	Tug	— —— —	94	......	Great Lakes Dredge & Dock Co., Chicago, Ill.
COLLINGWOOD SHIP BUILDING CO., COLLINGWOOD, ONT.					
Sand Point, Que	River tug	Hiram Robinson	108	......	Upper Ottawa Improvement Co., Ltd., Ottawa, Ont.
Collingwood	Steel Hopper Barge	— —	130	......	Owen Sound Dredge & Construction Co., Ltd., Owen Sound, Ont.
Collingwood	Steel Hopper Barge	— ——	130	......	Canadian Dredging Co., Ltd., Midland, Ont.
Collingwood	Freighter	Emperor	525	9,000	Inland Navigation Co., Hamilton, Ont.

THE GYROSCOPE FOR MARINE PURPOSES[1]

By Elmer A. Sperry.

THE uses of the gyroscope at sea fall properly under four general divisions: First, in affording means for resisting and preventing rolling of vessels or even rolling and controlling their motions at will; second, its use as a marine compass; third, for holding automobile torpedoes to their course; fourth, for artificial horizons in connection with observations at sea. There are two other uses which may be noted, that of recording the motions of ships, and also the use of a small gyroscope in controlling the oscillation of large active gyroscopes for purposes of preventing rolling motions of the ship in their inception, and thus holding the ship against rolling. The first three only will be treated briefly in this paper.

[1]Paper read at the annual meeting of the Society of Naval Architects and Marine Engineers, New York, November, 1910.

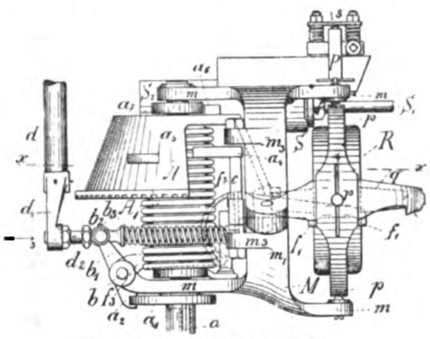


Fig. 1—The Obrey Gear.

Previous to the introduction of the gyroscope, there have been three methods of steadying ships which afforded resistance to roll. "The oldest steadying gear," as pointed out by Sir John I. Thornycroft, "was probably the sail, though not originally intended for that purpose." He goes on to say "that the extended use of steam is depriving passenger vessels of this ancient steadying gear and causing increased rolling. For comfort at sea, we require in our ships some device that will afford resistance to roll, the need being an' increasing one."

Lord Kelvin has measured angles of roll in crossing the Atlantic of 40 degrees each side of the vertical, giving a total angle of motion in a single roll of 80 degrees.

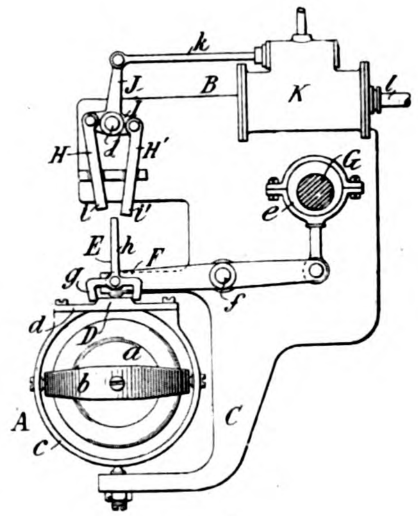
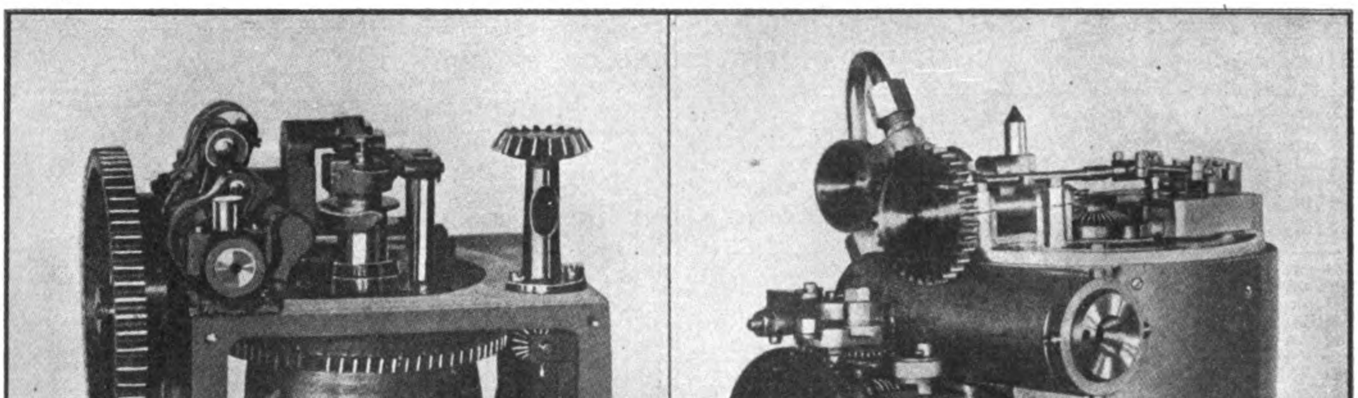


Fig. 4.



Figs. 2 and 3. The Leavitt Directing Gyroscope.

The early work of Froude, his colaborers and successors, in applying athwarthship tanks for prevention of rolling is well known. These, together with rolling ballast and the great moving weight of Thornycroft himself, all fall under the head of moving the center of gravity of the ship in attempting to balance the wave effect and prevent rolling.

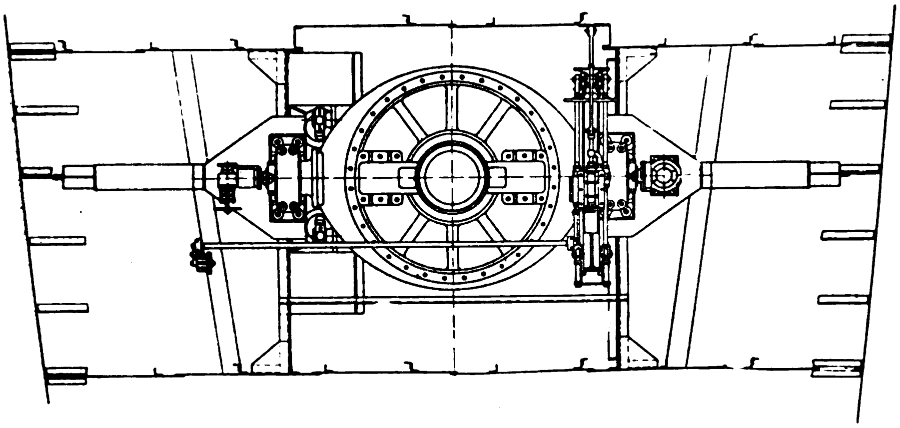


FIG. 5—PLAN OF THE FIRST SCHLICK GYROSCOPE.

About this time bilge keels were introduced and their characteristics are quite well understood, being effective only in heaviest rolling. Quite large bilge keels were found to equal about three-fourths of the surface hull and keel action for all angles of roll. The comparison between bilge keels and 1 per cent of water ballast in athwartship tanks is interesting. Very large keels were found to be only one-eighth as effective at 3 degrees roll from the vertical, one-fourth as effective at 5 degrees roll, only equaling at 12 degrees roll, and being three times as effective at 18 degrees roll. They are also known to increase materially the resistance skin friction and motive power required in all weathers. Sir John I. Thornycroft introduced a method of anticipating the rolling by the means of a controlling mechanism compounded of many active features involving a short and a long pendulum, a retarding device and a cataract all organized to co-act. These were operated on the floating link principle, a moving ballast being operated by heavy hydraulic machinery in the hold of the ship.

It is more than probable that the true engineering significance and the enormous power of the gyroscope were first discerned in this country; that is, observations concerning it were first made here. It happened in this wise. There was in the early history of our navy a torpedo known as the Howell torpedo, which depended for its action upon the rapid rotation of a fly-wheel. The torpedo was a cigar-shaped craft and amidships there was a steel wheel some 16 in. in diameter which was rotated up to about 16,000 revolutions per minute. As a matter of fact, the speed of rotation was so great that the 1-64-in. clearance left round the periphery was taken up by the centrifugal stresses acting upon the elasticity of the steel of the wheel, which was thus utilized as an automatic brake. This wheel was coupled to and served to drive the propellers when spun up.

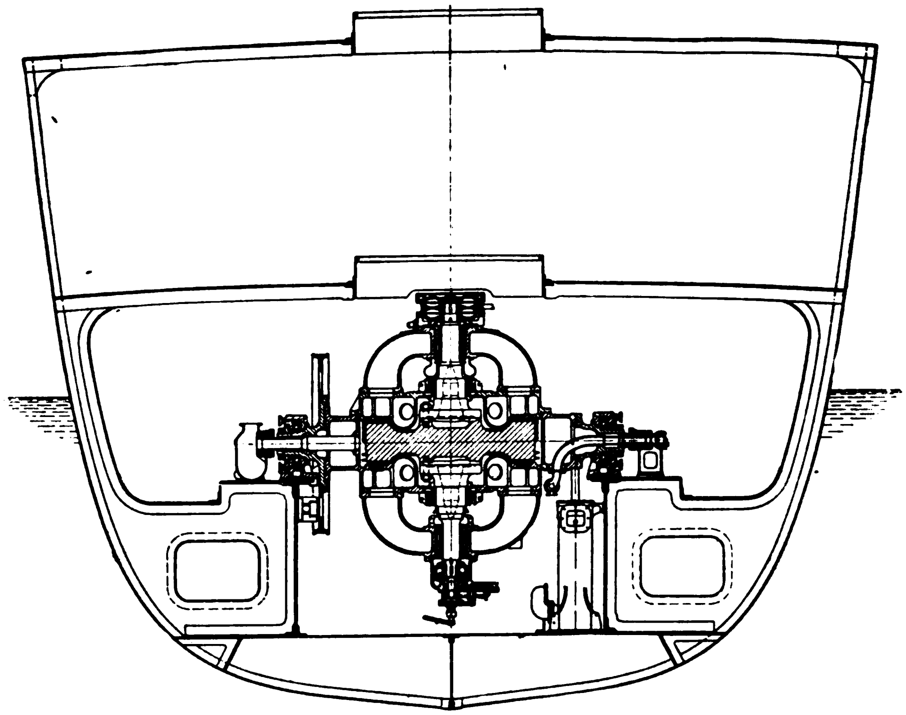


FIG. 6—SECTION AND FORWARD ELEVATION OF SCHLICK GYROSCOPE.

We had in America at this early period the forerunner of the present steam turbine, viz., the Dow steam turbine, which was directly connected in such a way as to spin the massive wheel up to 16,000. Mr. Nixon, late of the United States navy, had charge of some attempts at markmanship with the Howell torpedo. He was anchored a certain distance from the target, and some difficulty was experienced in starting the steam turbine, but after a time, they succeeded in getting the turbine going and gradually spun the wheel up. You understand it takes considerable time to store energy in a revolving mass and attain this high velocity. After the velocity had been reached and everything was ready, lo and behold! —the anchored ship on which the machinery was located, had turned, the tide having changed, and instead of the torpedo now being pointed at the target, it was found that the target was considerably to one side of the direction in which the torpedo now pointed. Mr. Nixon called upon his crew to change the torpedo and point it toward the target, but they found this difficult. They had no trouble in getting it up, but no effort sufficed to budge it laterally; it would not change its direction. So more men were called for. It simply had to come and finally it started slowly and the officer saw they changed its position, relative to the boat, considerably, so he stepped back and took a sight as to its alignment with the target and to his great surprise, he found the target was still

in the same quarter. In their efforts they had simply moved the ship around under the torpedo which contained the spinning wheel and which had refused to move. This was one of the first times that the real power of the gyroscope had manifested itself; it became noted in engineering circles.

As to some other uses of the gyroscope. The most extensive is probably the automatic steering gear in Whitehead torpedoes. This gear is simply used for the purpose of lateral guiding the torpedo and holding it to a straight course. This little gyroscope has a secondary ring which may precess—it offers positive resistance to any effort to turn it from its course, and this resistance is used to operate valves and, through a secondary motor, the rudders. This use originated with Obrey, an Austrian naval officer (see Fig. 1).

Our own member, F. M. Leavitt, engineer of the E. W. Bliss Co., New York, and inventor of the Bliss-Leavitt torpedo, has greatly increased the efficiency of the "gyro" gear of torpedoes, as he has greatly improved the torpedo itself. Figuring from the increased speed and radius of action, he has increased the power factor of the old Whitehead torpedo 20 times and without materially increasing the air pressure carried. He has accomplished this by a wonderfully bold piece of engineering; that is, by automatically burning a fuel directly in the pressure air current, thus greatly increasing its temperature. The reciprocating engine of the Whitehead is replaced by a pair of little Curtis turbines. It should be remembered that every doubling of the absolute temperature doubles the volume, and while he starts out with a small amount of air, he reaches the turbine with an immense volume under the requisite pressure, enormously increasing the power generated; an exceptionally interesting piece of engineering.

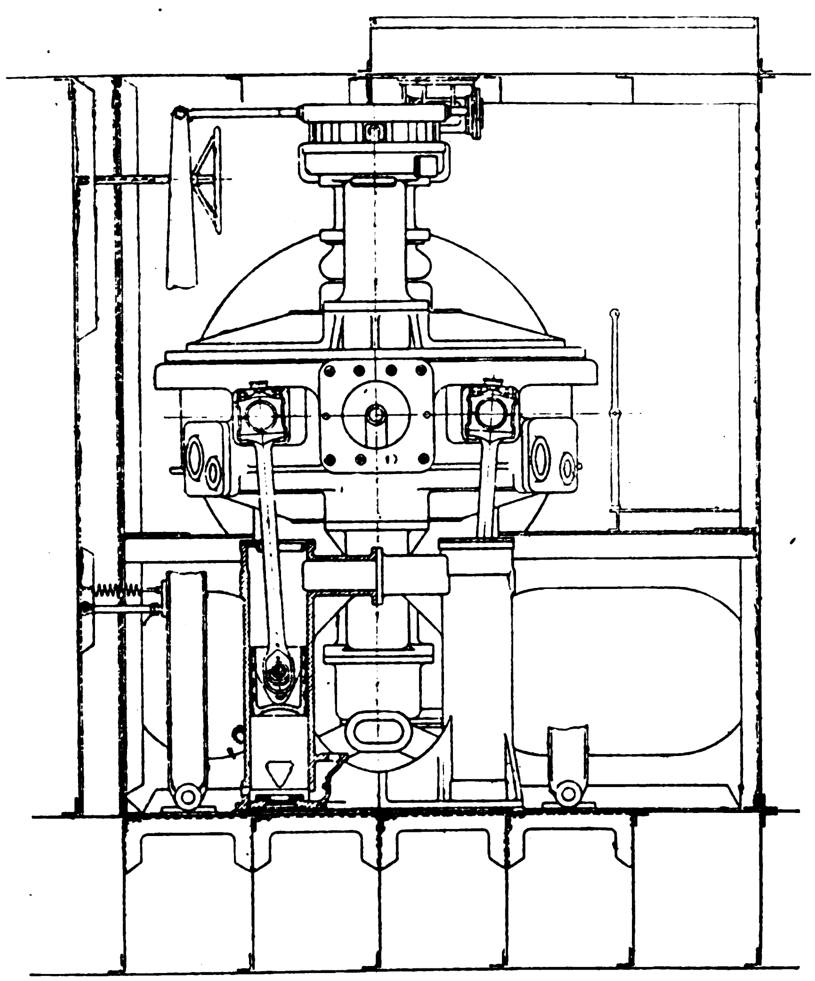


FIG. 7—SIDE ELEVATION OF SCHLICK GYROSCOPE.

Figs. 2 and 3 show two types of the Leavitt directing gyroscope; this is small and he has increased its accuracy by unloading the base ring; instead of asking the base ring to do the work of moving a valve, he cuts the duty required down to about one-hundredth of that required in the Obrey gear and makes it give a simple directive factor to an extremely small pivoted pawl at the instant the pawl is otherwise perfectly idle. Fig. 4 shows this vibrating pawl at E.

Dr. Schlick, a noted engineer of Hamburg, Germany, has done much in connection with the gyroscope. It is to Dr. Schlick's genius that we largely owe the vibrationless reciprocating marine engine. He has gone further in the installation of large gyroscopes for steadying ships than any other. His gyroscope is of the passive type. He is a practical engineer, and at first called to his assistance a number of other engineers and mathematicians and designed the first machine. The working drawings of one of these machines are of interest; they are presented in the following figures: Fig. 5 is a plan, Fig. 6 is a forward elevation, and Fig. 7 a side elevation. Fig. 8 shows the complete machine as it was installed on board the Silvanna.

In Germany, in 1909, Dr. Frahm had succeeded in overcoming one of the reasons for eliminating the water chambers from the old English men-of-war—the noise of the tons of water rushing from side to side, which is said to have been intolerable—by using an inverted siphon. The trouble with this arrangement is that the central opening has to be of such a character as to cause the movement of the water to be synchronous with the boat's period; that is, if in addition to the simple gravitational factor of the water the kinetic energy of the rushing water is to be utilized; while the boat in still water has a fairly uniform period and the movement of the water in the arrangement can be made to conform to a given period, in rough seas, however, the boat is not periodic, varying a great deal. I have seen automatic rolling diagrams where the period varied from seven seconds to seventeen seconds. Now when the flow of this great quantity of water gets out of synchronism it becomes a menace, and makes the boat roll more and behave worse. Some rolling diagrams are shown in Fig. 9.

The eminent engineer, Sir John I. Thornycroft, of England, did much valuable work in attempts to overcome the last-named difficulty. He placed a great moving weight on a vertical axis which could move as a pendulum in the hold of the ship. An equipment of hydraulic apparatus was provided for swinging this weight from side to side (see Fig. 10). By

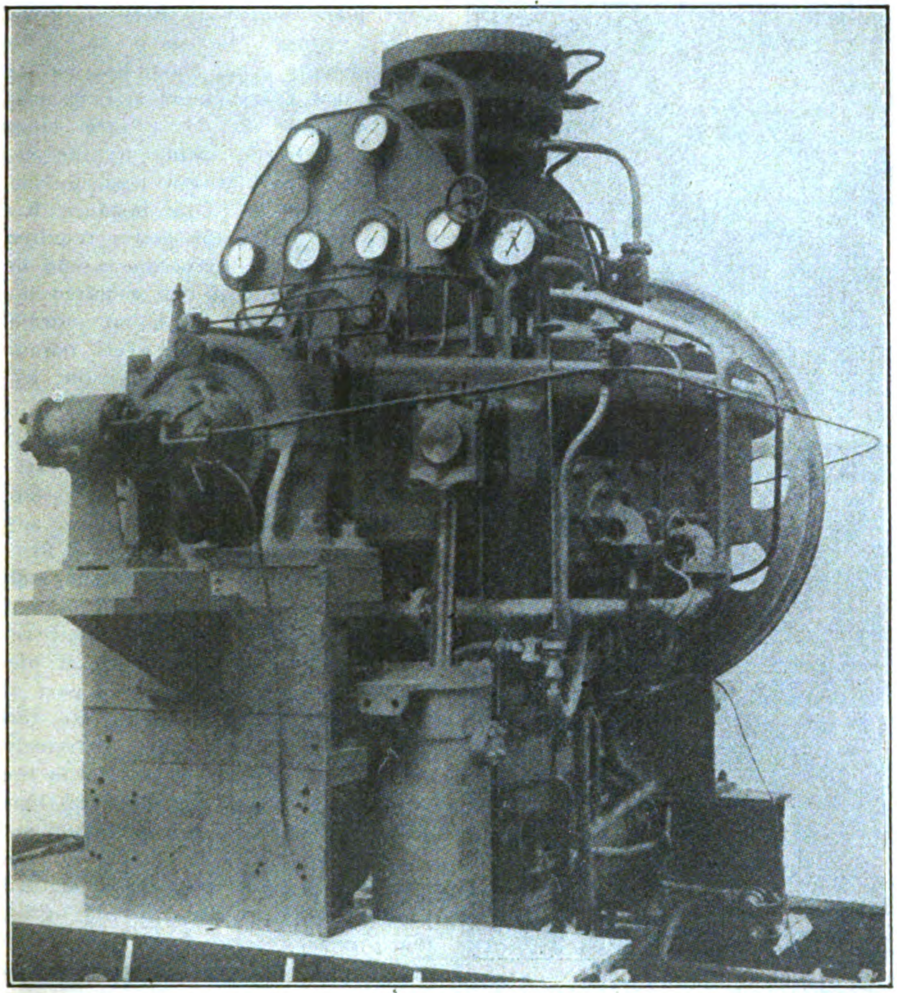


FIG. 8—SCHLICK GYROSCOPE COMPLETE.

this means the center of gravity of the ship could be changed at will. The weight was about 5 per cent of

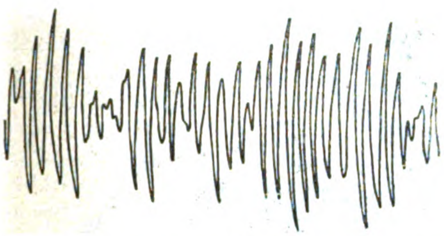


FIG. 9—DIAGRAM OF ROLLING MOVEMENT.

the total displacement of the ship, but it was governed by the controlling apparatus mentioned above, in such a way that he succeeded admirably in anticipating all the needs of the ship up to the capacity afforded by this moving weight. The weight had the power of tilting the ship just 2 degrees either side of the vertical when swung to its extreme lateral positions. In sea trials of this arrangement, Sir William White states that it reduced 18 degrees of roll to 9 degrees. To eliminate wind and weather conditions the boat was made to sweep through an entire circle in heavy seas. This was the first attempt to steady a ship by a controlled reactionary force. The difficulties encountered with this, the water tanks and all other gravitational methods, are that each pound of weight is enabled to do the work of only one pound and the weights and auxiliary machinery required have been thought to be prohibitive; and furthermore, the weight, when on one side or the other, constitutes a persistent unbalancing or listing force, whereas the gyroscope is enabled to deliver stresses pure and simple without disturbing the balance of the boat or introducing any list whatever.

The problem of preventing rolling of ships at sea has been attacked by a great many engineers. Last year while in Hamburg, I saw the latest arrangement of Engineer Frahm, some large naval vessels for the Russian government now being built with his arrangement for steadying ships, involving enormous tanks amidships, which will contain from 350 to 400 tons of water, through the rushing of which, back and forth, a part of the true periodic roll will be extinguished, but only a part and only when periodic. The eminent authority, Dr. Schlick, states with reference to this arrangement that it will become a positive menace and cause excessive rolling when the ship's oscillation falls out of period, which it invariably does in a storm. This, however, is interesting, as showing the great desire to prevent rolling of ships and especially war vessels.

The gyroscope, on the other hand, is not limited to any particular period of the boat; it simply responds to whatever motion the ship has, synchronous or non-synchronous. The question is often asked: Why is the gyroscope better than a moving weight in a ship for roll quenching? Barring the matter of list produced by the changes of center of gravity of the ship by the moving weight, the reason is perfectly apparent when

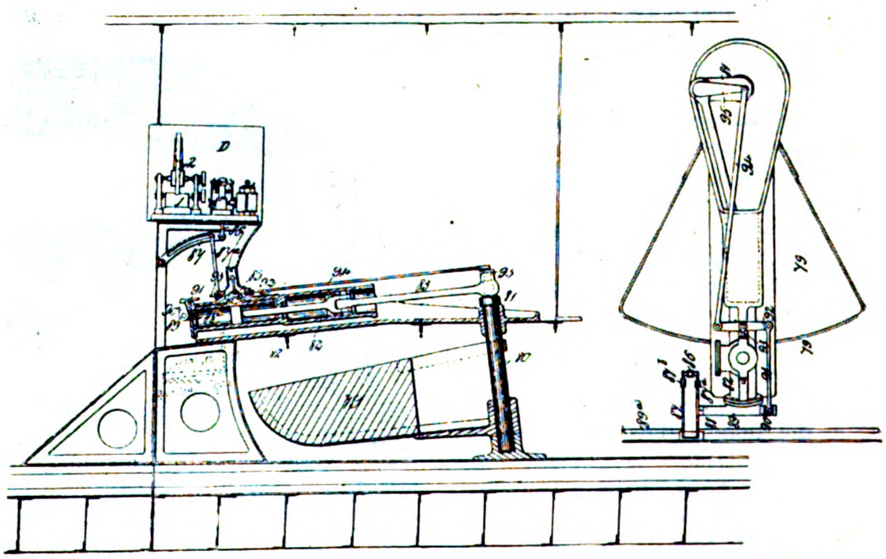


FIG. 10—THE THORNYCROFT APPARATUS FOR SUPPRESSING ROLLING.

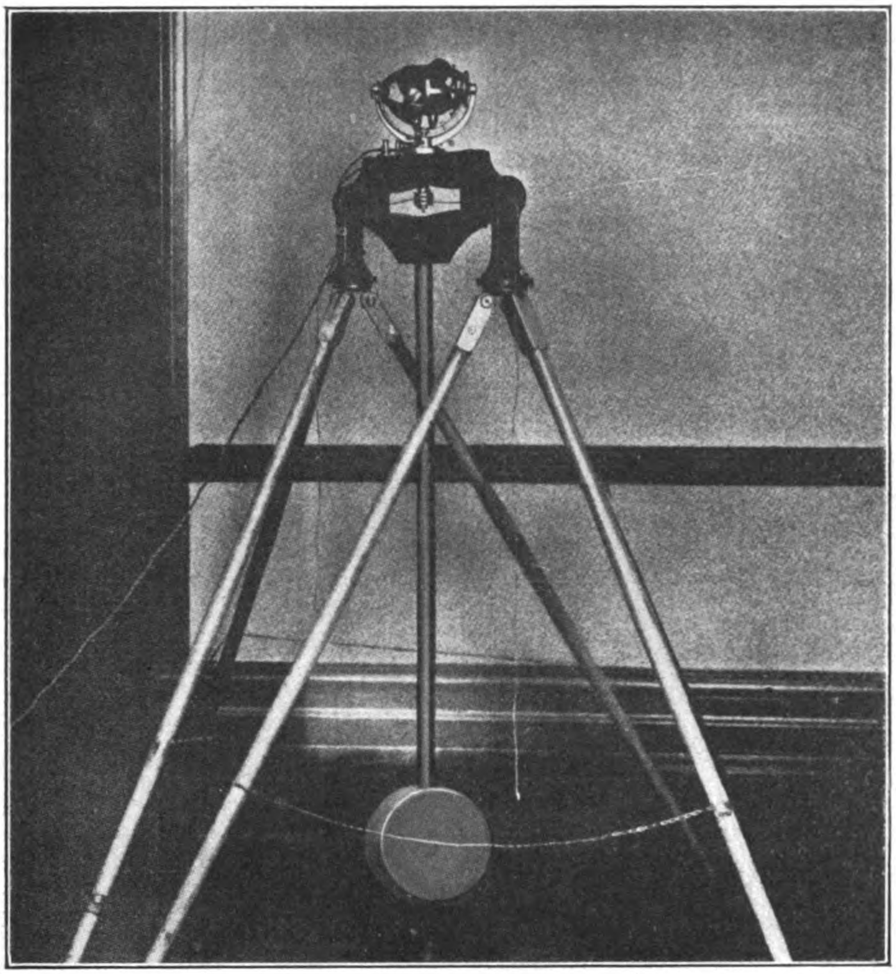


FIG. 11—PENDULUM, ILLUSTRATING THE ACTION OF A GYROSCOPE.

ships plane and thus hold the ship against rolling. We can do this with a surprisingly small mass, because, as I have said, every pound in that mass can be made to do a very large amount of work, owing to the velocity that may, at low cost, be impressed upon it. One instance has been noted where the power required for operating the gyroscope would be about 5 per cent of that required for driving the bilge keels at normal speed of the boat; the keels requiring power in all weathers, the gyroscope only when needed.

A primary motion on the part of a body, for instance, the slow athwartship or rolling motion of a ship, exerts gyroscopic forces upon any vertical spinning shaft and in a fore-and-aft direction. These forces tend to dampen the rolling motion but only feebly, and the fore-and-aft reaction, owing to the absence of motion, does not at all. It is a part of the general plan to so utilize this force as to make it create extremely large reactions athwartships or in the proper direction to be effective. This is accomplished by the ingenious yet simple expedient of mounting the aforesaid vertical shaft in a pivoted frame so that it can tilt and utilize the primary fore-and-aft reaction to cause the axis of the spinning mass to tilt fore and aft. This motion is

you recall the magnitude of the stresses obtainable from a small machine. Every pound in the rotating mass of the gyroscope can easily be made to do the work of from 150 to 200 pounds, and directed in any desired line or plane, whereas, when we use water or any other form of moving weight, each pound represents a pound only, and can do the work of only a pound, and only in a vertical direction.

The gyroscope is probably the only device in the world by means of which stresses and also energy may be transferred "around a corner," so to speak. With the gyroscope it is possible to create and maintain a very powerful fulcrum in space effective for the heaviest kind of mechanical duty.

Now on board ship there is one factor that is stiff and is now available, and that is the fore-and-aft stability of the ship. In the gyroscope, for the first time, we have the means of rendering it possible to reach out and transfer this stability around a corner, so to speak, to the athwart-

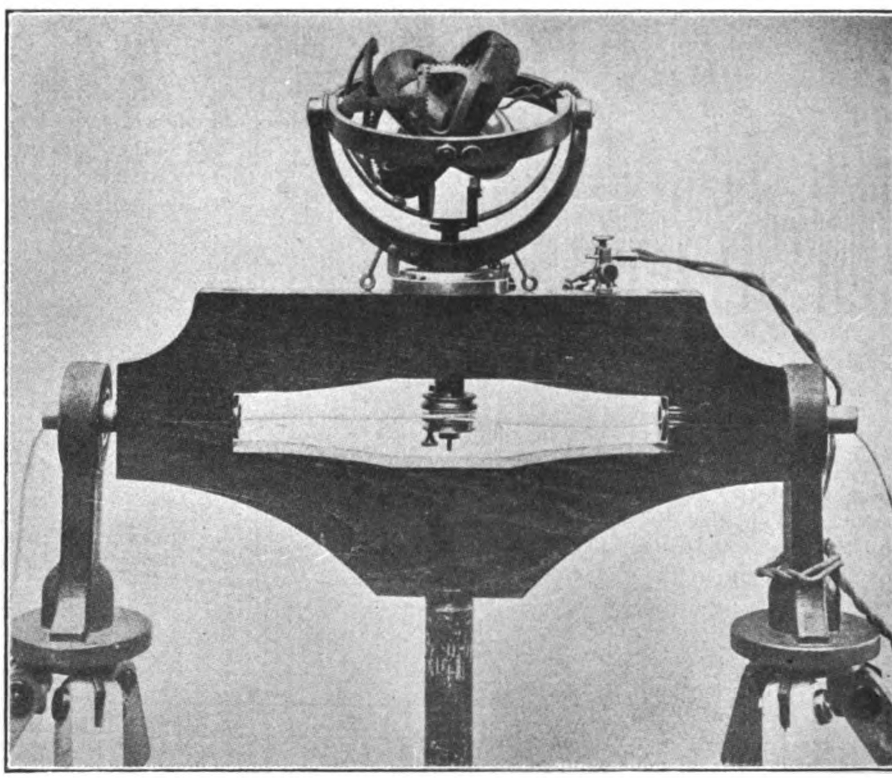


FIG. 12—ENLARGED VIEW OF HEAD OF APPARATUS, SHOWN IN FIG. 11.

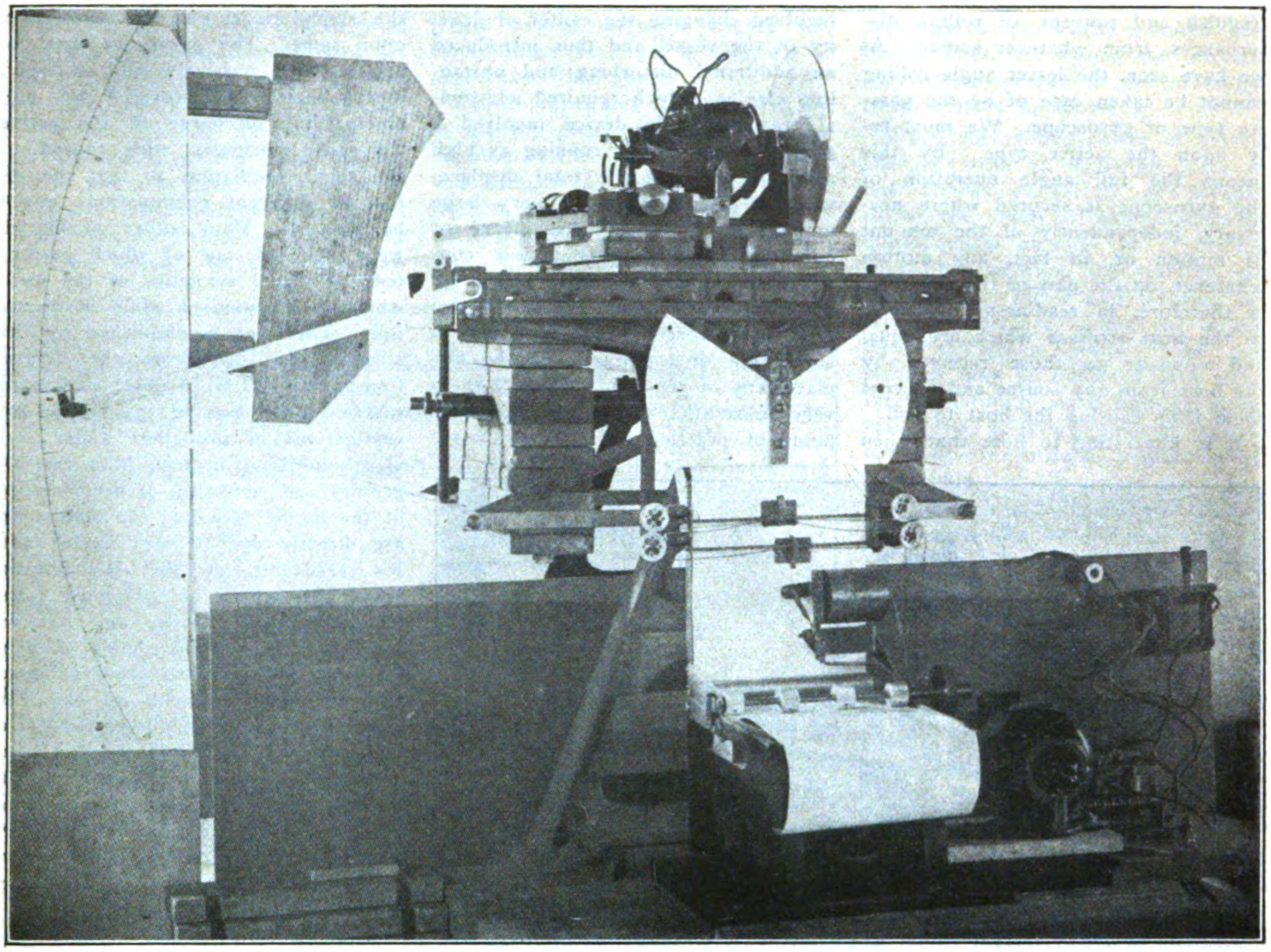


FIG. 13—FRONT VIEW OF EXPERIMENTAL GYROSCOPE APPARATUS AT WASHINGTON NAVY YARD.

of much higher velocity than the angular motion of the vessel which produces it. By means of this tilting motion an entirely new gyroscopic force is set up, again at right angles as in the first instance, but now to the plane of tilt (fore-and-aft) which brings it back to the original athwartship plane just where needed; and, what is equally important, the reaction is in a direction exactly opposed to the roll of the ship which primarily called it into action, as well as this whole chain of phenomena which we have thus traced through a complete cycle of 180 degrees of angle and also through an enormous augumentation of righting moment and stabilizing power.

In Fig. 11 we have a pendulum with a small gyroscope mounted upon it. This pendulum has freedom of oscillation upon its two gudgeons. All ship's roll being pendulic this may be considered to be a ship with a small gyroscope upon it. The spinner weighs but little and it spins at a very low velocity compared with what a well-organized gyroscope will do.

The Active Gyroscope.

In Fig. 12 a cord is seen passing through the two gudgeons of the pendulum just above the tripods, and at a point midway between these gudgeons the cord passes around one of the little horizontal pulleys immediately below the gyroscope arranged in an elongated opening in the wooden top of the pendulum. These pulleys operate the little pinions in the lower middle portion of the fork of the gyroscope, one being geared directly to the base ring, shown horizontally in Fig. 12, and the other operating the precessional ring through an intermediate miter segment. This arrangement affords means wherey either of these rings may be tilted at will by the simple act of drawing the cord through the center of the gudgeons, and round either one or the other of the pulleys. No movement, manipulation or stress whatsoever applied to the cord, could in any way affect the oscillation of the pendulum for the reason just stated that the cord passes through the center or axis of this oscillation, and in line therewith.

It will be observed, in operating this model, that the gyroscope itself fails to respond to all the smaller angles. It responds freely to the large ones or wide angle oscillations but either does not respond at all or moves very slightly with the smaller oscillations as stated. Not responding, it cannot, of course, control or extinguish these smaller oscillations. It being desirable, especially in connection with improvement in conditions for gunnery on war vessels generally, that the gunner should operate from a level gun platform, it therefore becomes desirable to act on these smaller oscillations of roll of the ship so as to completely extinguish them and hold the ship on a practically even beam; this more especially as now all larger war vessels are designed for broadside service and volley fire. The gunner, therefore, is compelled to keep an absolutely true and incessant aim upon the target. If the ship is rolling much or little this is a more difficult task. Again, the recoil from the volley fire lists the boat over and sets up rolling, and it is the duty of the gyroscope to ex-

tinguish and prevent all rolling disturbances, from whatever source. As we have seen, the lesser angle rolling cannot be taken care of by the passive type of gyroscope. We must rely upon the active type. By this means the full angle operation of the gyroscope is secured where necessary, independently of the amount of motion or, in fact, any motion whatever, on the part of the ship, and is therefore, in readiness to deliver to the boat stresses which are equal and opposite to those received by the boat from any source and prevent them from causing the boat to roll.

It is interesting to note that when the boat is held free from motion, as by the delivery of stresses equal and opposite to balance the wave effort, no power is required to actuate the gyroscope other than to overcome inertia and friction, which is almost negligible. When the roll is being suppressed and the boat is moving then the boat is doing work upon the gyroscope, and it then becomes the province of the actuator to emplace the oscillations of the gyro properly with reference to those of the boat, and at such angular velocity as to best suit the conditions, structure and mountings.

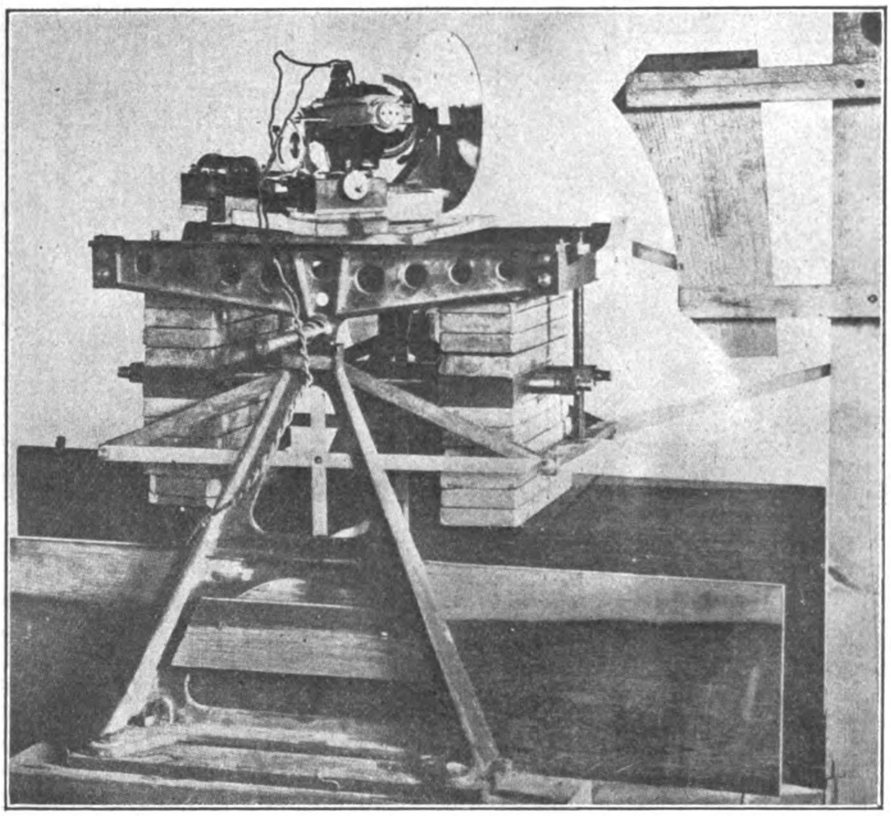


FIG. 14—REAR VIEW OF EXPERIMENTAL GYROSCOPE APPARATUS.

The work of Sir John I. Thornycroft for preventing rolling, and his devices, which are shown in Fig. 10, involved changing the center of gravity of the vessel and thus introduced an additional disturbing and unstabling element which required additional treatment; his device involved a great moving weight running as high as 5 per cent of the total displacement of the boat and a very large amount of hydraulic machinery for handling these weights and a considerable amount of motive power for operating them. But with the active type of gyroscope, we find that a small part of 1 per cent of the displacement of the ship will perform a very substantial service, down to the point of practically fully extinguishing rolling. By the use of this device, there is entire absence of any shift of the center of gravity of the vessel, and its stability remains unchanged. The sizes, weights, speeds and location of a gyroscope for this purpose are among the points which have been canvassed in tests carried on at the Washington navy yard during the present year.

Figs. 13 and 14 show front and rear views, respectively, of a working model of a 26,000-ton battleship of the super-dreadnought class, with 5 ft. metacentric height and 18 seconds period of roll, capable of rolling through a total arc of 60 degrees; means are provided for autographically recording all motions, both of the ship's model and the gyroscope, upon same. The gyroscope was operated both passively and actively; means were also provided for emplacing the discharge of the active gyroscope variously with regard to the ship's oscillation so that the effect of different combinations might be studied. Many other auxiliaries were provided, one of which permitted the actual velocities of the gyro wheel to be counted while in operation. This was accomplished by the stroboscopic apparatus of Naval Constructor D. W. Taylor, similar to that used by him in his classic investigations of propellers under service conditions, in fact, both the ingenuity and reliability of performance of the model ship and the auxiliaries are directly due to Mr. Taylor and his assistants at the Washington yard. By means of this very complete equipment studies and records have been made and charts of performance prepared and other valuable data accumulated, much of which is new, as many of the observations, we believe, were never before undertaken. The investigations with the active type of gyroscope are in a new line of research; the results obtained are important in point of much more perfect control of the ship's roll than heretofore possible.

Constructor Taylor has prepared a very full report upon this work, forming a part of which is a forty-page appendix in which he treats the question in a most masterly manner under some sixteen heads. In this most unique and valuable work, he has given an original mathematical treatise on practically all the phases and bearings of this question, including an original investigation of the underlying phenomena of the gyroscope itself. It is of the greatest value to this important art that its problems should have come under the observation of and been reviewed by so able a mathematician, experienced in all branches of experimental research, and fitted by long training to judge of the practical bearings of the results, extending, as does this experience, to the very largest undertakings and structures in marine work. To give some idea of the great amount of work involved and also of the abstruse character of this work, I take the liberty of here reproducing as Fig. 15 an isolated page of Taylor's forty-page treatise above referred to. It is to be hoped that the author himself may be prevailed upon to give the society a paper including this valuable treatise.

The practical effect in operation of the active type of gyroscope is to secure a large reduction of weight over and above that possible with the passive type. One of the reasons for this becomes apparent from the action of the pendulum which we have canvassed. With the smaller angles of roll, the gyroscope would have to be large enough so that its small angles of response would develop the required energy for extinguishing or still further reducing the roll, complete extinguishment being impossible; whereas with the active type the full 180 degrees oscillation of the gyroscope is always available, where required, for the extinguishment of large or even the smallest angles of roll as necessary. Thus an extremely small machine, taking advantage of the larger angles, between twenty and thirty times as large, is sufficient to accomplish this purpose.

$$\frac{M'_z}{mr^2} = (\alpha^2+\beta^2)\sin\psi\cos\psi\cos\phi - 2\alpha\beta\sin^2\psi\sin\phi + \gamma\sin^2\psi\cos\phi$$
$$+\delta\sin\psi\cos\psi\sin\phi - \alpha^2\sin\psi\cos\psi\cos\phi + \gamma\cos^2\psi\cos\phi.$$
$$= \beta^2\sin\psi\cos\psi\cos\phi - 2\alpha\beta\sin^2\psi\sin\phi + \gamma\cos\phi + \delta\sin\psi\cos\psi\sin\phi$$

Now as before put $m = \frac{w}{2\pi g}d\psi$

Then

$$M'_x = \frac{wr^2}{2\pi g}\left[\beta^2\sin\phi\sin\psi\cos\psi d\psi + 2\alpha\beta\cos\phi\sin\psi d\psi + \gamma\sin\phi d\psi - \delta\cos\phi\sin\psi\cos\psi d\psi\right]$$
$$M'_y = \frac{wr^2}{2\pi g}\left[-2\alpha\beta\sin\psi\cos\psi d\psi + \delta\cos^2\psi d\psi\right]$$
$$M'_z = \frac{wr^2}{2\pi g}\left[\beta^2\cos\phi\sin\psi\cos\psi d\psi - 2\alpha\beta\sin\phi\sin^2\psi d\psi + \gamma\cos\phi d\psi + \delta\sin\phi\sin\psi\cos\psi d\psi\right]$$

Evidently the moments for a complete ring of radius r and weight w will be obtained by integrating the above expressions with respect to ψ from 0 to 2π.

Now

$$\int_0^{2\pi}\sin\psi\cos\psi d\psi = 0 \qquad \int_0^{2\pi}\sin^2\psi d\psi = \pi = \int_0^{2\pi}\cos^2\psi d\psi$$

Let M_x M_y M_z denote the moments for the complete ring. Then evidently

$$M_x = \frac{wr^2}{2\pi g}\left[2\pi\alpha\beta\cos\phi + 2\pi\gamma\sin\phi\right] = \frac{w}{g}r^2\left\{\alpha\beta\cos\phi + \gamma\sin\phi\right\}$$

FIG. 15—A PAGE FROM TAYLOR'S TREATISE ON THE GYROSCOPE. NOTE THE "EVIDENTLY."

Fig. 16 illustrates three curves, one at the top giving the number of oscillation of the ship's model before it was brought to rest by the natural friction, having been originally tilted to 25 degrees to one side of the center. The shorter or central curve illustrates the number of oscillations of the model with the gyroscope acting passively or on Dr. Schlick's plan, the several rolls of smaller magnitude at the end being omitted where the passive type of gyroscope failed to respond; and a still shorter curve at the bottom shows the number of oscillations of the ship in being brought to rest, absolute freedom from motion being possible by the same gyroscope when operated actively. These are among the interesting results reached in the investigations referred to above.

When the motive power of vessels changed from an upsetting force to one almost exclusively of forward thrust, the design of ships underwent quite radical changes in connection with lines affecting the stability, decreasing this factor and favoring decreased resistance, aiding the attainment of higher speeds. Now that stability may be imparted to a structure of naturally small righting movement, and, as is well known, even to structures in unstable equilibrium, it is possible that we are on the eve of even more radical changes in design. Ships may now be designed that are practically free from those ballistic qualities which favor rolling structures to which unequal sea pressures easily impart motion need no longer be employed, as a comparatively small gyroscope which can easily be present in duplicate, may very readily hold them practically free from rolling motions in such a way that ordinary seas will have little or no effect upon them, while an exceptional wave will have only a temporary effect. It has been suggested in connection with such vessels that they need not pitch if of sufficient length; be this latter fact as it may, it is apparent that a point has now been reached and a situation created with reference to the resisting and prevention of rolling and motion of ships at sea that, to say the least, is interesting in many quarters. I heartily commend this subject to those who are interested in providing safety and comfort to passengers at sea, and as also preventing deterioration of certain classes of freight; for instance, live stock is known to suffer heavy depreciation in stormy weather. This is entirely outside naval uses, especially as related to gunnery, trimming ships to secure level gun platform, suppression of recoil from broadside firing and other uses.

It is evident from what we know that the early workers were hampered by too close adherence to the earlier treatment of statical stability, and the direct effect of wave slope together with some other elementary factors, rather than the more practical considerations of the effect of movements of the ship, stresses involved, etc.

In 1904 Dr. Schlick presented a paper before the Institution of Naval Architects. Accompanying this paper in

the form of an appendix is a mathematical treatise of the theory of the gyroscope and its application to steadying ships. There seems, however, to be little in this treatise which we find useful in the practical application of the gyroscope, especially the active type, to ships. Constructor Taylor, in his report on this subject, states of this treatise that it is a very elaborate mathematical theory, but that it largely ignores practical considerations.

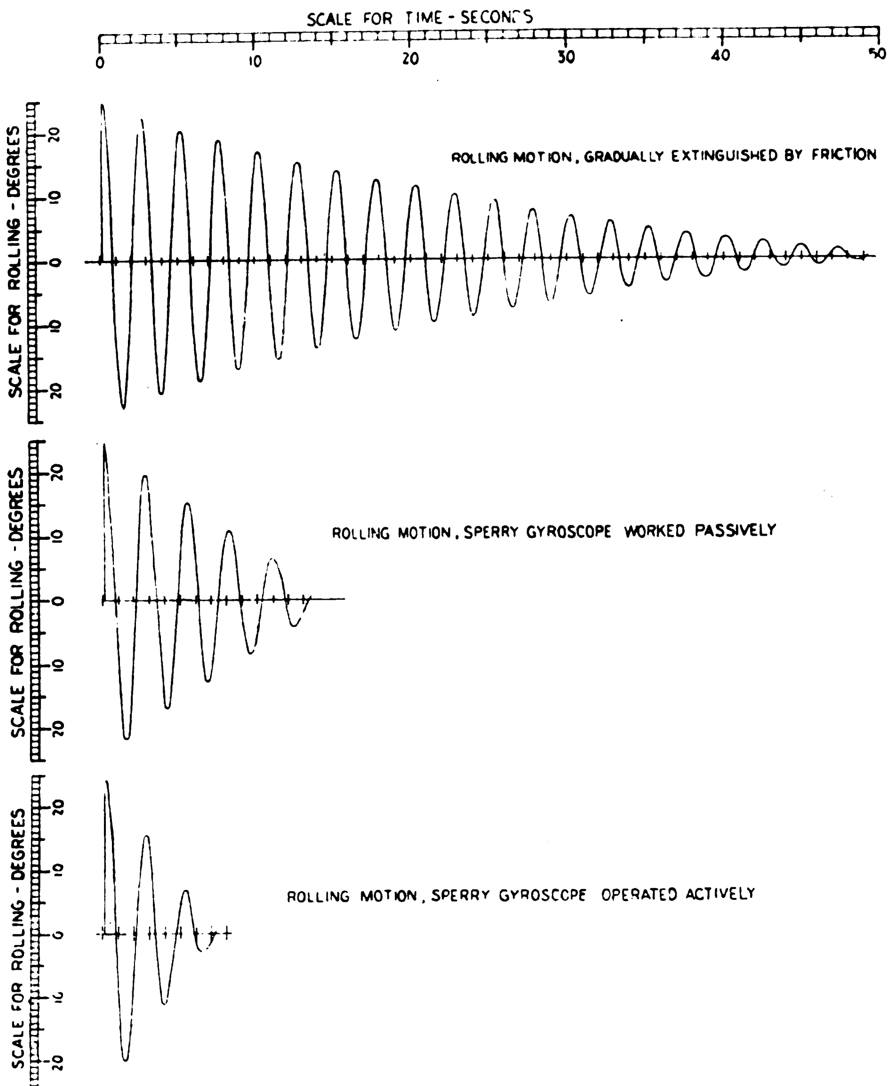


FIG. 16—DIAGRAMS FROM EXPERIMENTAL WASHINGTON APPARATUS.

The problem is a comparatively simple one, namely, of holding the ship against rolling by neutralizing with the gyroscope each disturbing influence as it reaches the ship while availing ourselves of all the aid possible through the design of the hull and disposition of the masses. With this end in view we do not yet know the best relation between these two factors. With the last adjusted to best fit the new conditions it is believed that the gyro-steadying plant of the active type will be well within practical limits of space, weight and cost. Especially is this true when compared with the practical results of its operation. A great many ships as they now stand could with profit utilize the gyro-steadying gear of this class, which is at present available, and some important installation are now being contemplated. In this connection it is interesting to note that the weight of an active gyroscope for each degree of roll-quenching power on a modern battleship would be about one-tenth that of the submerged armor displaced, and cost much less, this being outside of the very important consideration of having the entire ship under control either automatically to extinguish roll or at the will of the commander, with its many evident advantages.

Referring to the use of the gyroscope as a compass, it is interesting to note that the possibility was first brought out in 1852 by Foucoult, who, after many attempts, succeeded finally in making up an apparatus so delicate and so beautifully constructed as to demonstrate the working of the instrument in the short period of duration of spins of a small disc, the observations being taken through a telescope, the directive factor being only a fraction of that of the magnetic needle. With this difference, however, that magnetism or the location of variations in the positions of the magnetic meridian have nothing whatever to do with its directive feature, and, in fact, it points to exact geographical north, not to magnetic north.

About this time Foucoult took this apparatus to England and there aroused the greatest enthusiasm in scientific circles, by exhibiting it in operation to the Royal Society. Hopkins, in America, associated with the *Scientific American* in 1878 made a small electrically-driven gyroscope by means of which better and more persistent results were obtained. More recently, attempts have been made by a German firm to use mercury floats for sustaining the rotating wheel, constituting a gyrostat which, in this instance, runs at the enormous speed of between 22,000 and 23,000 r. p. m., which has been considered by many to be impractical. Those familiar with the use of mercury in the mechanical, and also electrical, applications usually find it very unsatisfactory. At best it is a volatile liquid, subject to many changes with differences in temperature, and, which is worse, is also subject to the phenomenon known as "sickening," which affects the surface of the mercury, and for some distance under the surface, altering its mechanical behavior and also its viscosity. The best engineering practice has for some years avoided mercury, drawing away from its use in every possible way, and especially where electrical connections were involved, and substituting, in its stead, simple mechanical methods which are free from these serious objections. Working in this line I have found simple details by means of which the whole gyroscope proposition is reduced to a strictly mechanical basis easily within the comprehension of all and containing no unknown quantities and correspondingly easily dealt with. In the cases where the gyroscope is employed as a battle compass, the apparatus is placed below decks, and small instruments about the size of an ordinary compass are distributed in dif-

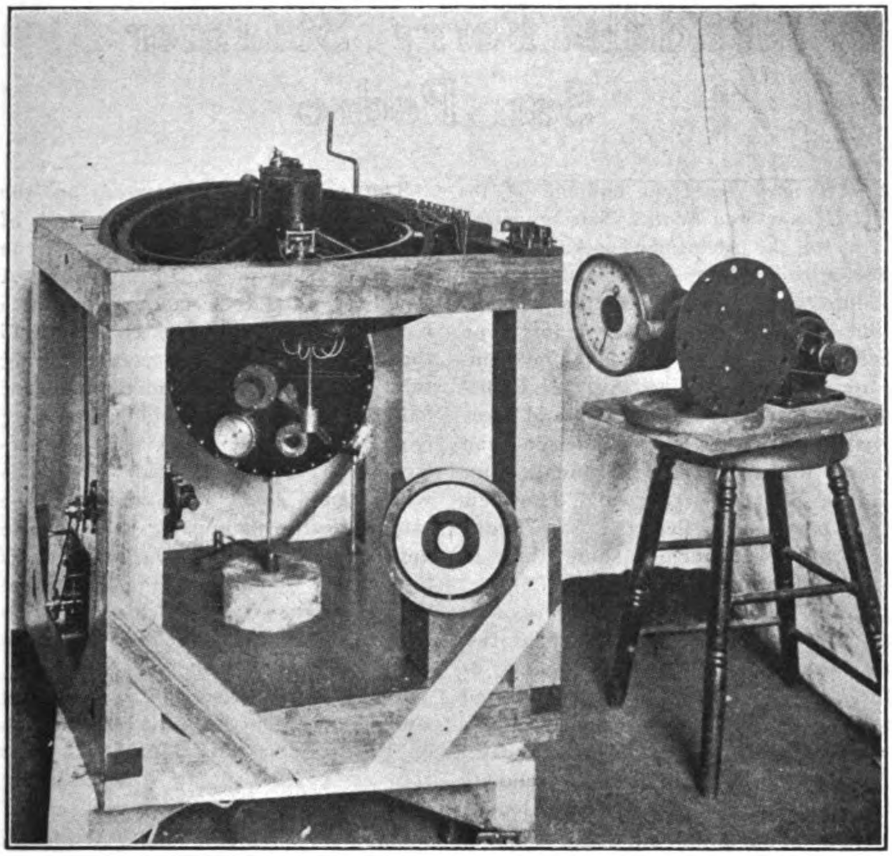


FIG. 17—MODEL OF GYROSCOPE MASTER BATTLE COMPASS.

ferent positions on the ship, giving the exact indications of the gyroscope compass itself.

My work has extended to the point where action of such instruments can be controlled from the gyroscope compass and distributed as desired, the indications being accurate to a very small fraction of a single degree. Many observations have been made indicating that they are accurate to thirty-six hundredths of an entire circle. Fig. 17 shows a view of the battle compass as it is mounted on an artificial ship which gives all changes of heading, as well as automatic continuous roll and pitch to which the compass is continually subjected. Both roll and pitch may be varied at will as to angle and period.

Figure 18 shows one of the receiving instruments for the binnacle or other position. It is found that this receiving instrument requires no cardian mounting and is equally accurate in any position, vertical or horizontal. Indications are held with the accuracy described following the master instrument instantly, and are very much more "dead beat" than an air compass for marine purposes, though they are not submerged nor is any liquid used in connection with them. Among the points never before realized is the automatic correction of the northerly or southerly component of vessels' speed at sea, this correcting being made between the gyroscope compass and its transmitting member, in such a manner that the indications received by the navigator and elsewhere about the ship are thus absolute and maintain true geographical north.

A settling curve taken from my gyroscope compass while in the operation of being started in the east and west position and brought up to about 4,000 r. p. m. only shows the instrument to reach true north in 34 minutes. At normal speed the directive force is about 6,600 times that of the compass needle.

It is felt that the navigator has now at hand a most desirable aid and one that greatly simplifies his work. It will be understood that this type of compass is not affected in the slightest degree by the steel of the ship, or cargo, nor any magnetic disturbances in either; neither should shifting cargo, turning turrets nor gunfire, nor the striking of the ship by a shot disturb its accuracy or reliability, nor is it affected in the slightest by those disturbances technically known as deviation or variation.

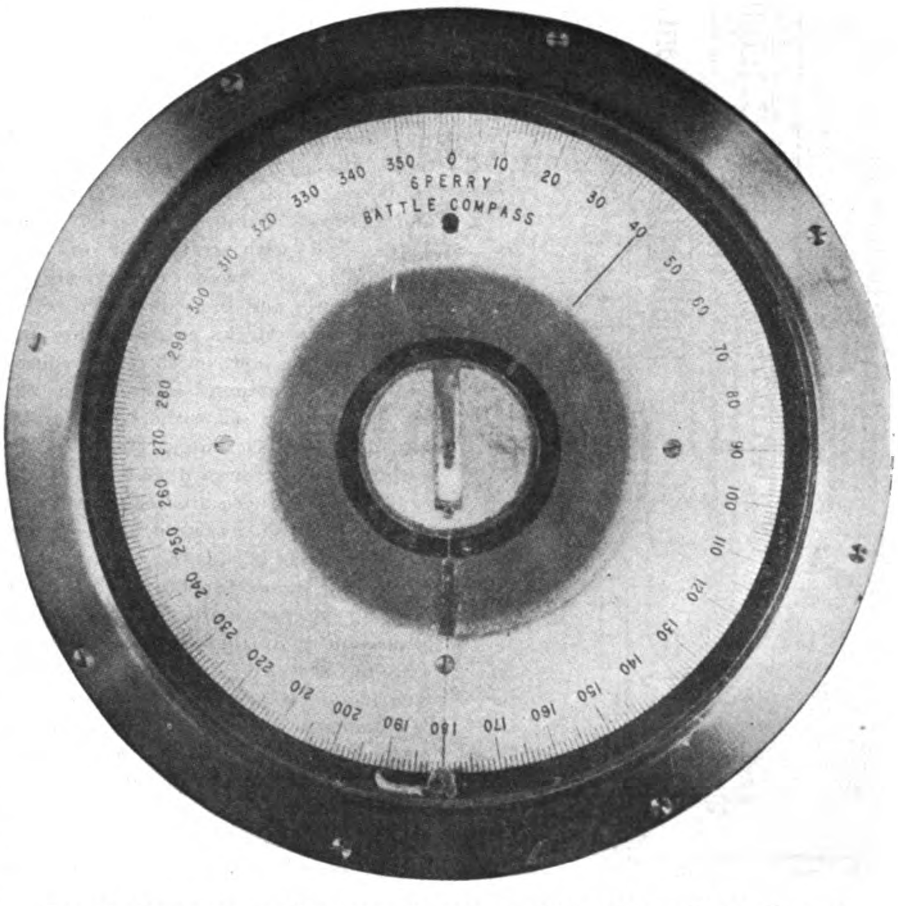
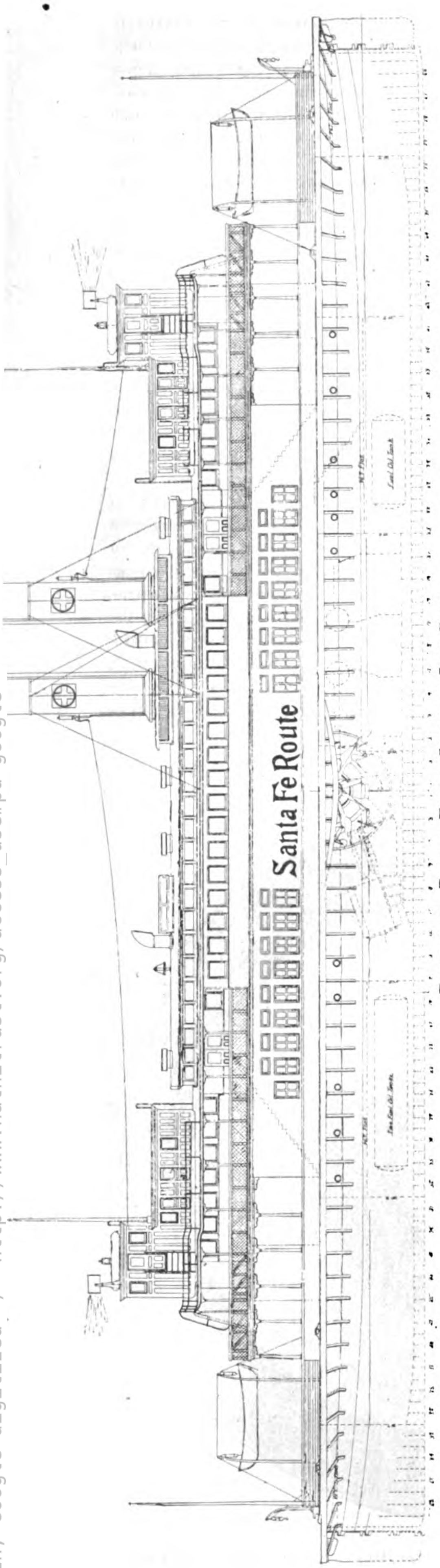


FIG. 18—SECONDARY OR RECEIVING COMPASS FOR BINNACLE OR OTHER POSITION.



PROFILE OF PADDLE FERRY STEAMER SAN PEDRO.

Paddle Ferry Steamer San Pedro

THE new ferryboat building at the Union Iron Works, San Francisco, for the Atchison, Topeka & Santa Fe Railroad Co., is of the double ended paddle type, with feathering wheels. This is the second boat of this type built at this works for the same company, the other being the San Pablo, finished in October, 1900, and now plying between San Francisco and Point Richmond, the terminal point of the Santa Fe railroad. The new boat is to be called the San Pedro and will be launched some time in March, 1911.

Vessel with machinery, boilers, outfit, life-saving, fire and oil apparatus, will conform to the requirements of Lloyds and, of course, to the United States steamboat inspection rules.

The general dimensions and coefficients for the hull are as follows: Length over all, 259 ft. 6 in.; length between perpendiculars, 248 ft. 6 in.; beam, molded, 36 ft.; beam, over guards, 64 ft.; depth, molded, 18 ft. ½ in.; draught, 10 ft 1 in.; displacement, tons, 1,353; tons per inch at above draught, 15.64; block coefficient, 0.565; prismatic coefficient, 0.669; area of midship section, 285.4 sq. ft.; wetted surface, 9,280 sq. ft.

The vessel is divided into seven watertight compartments; two peak tanks fitted to carry fresh water; two holds, one with fuel oil tanks in hold and crews' living quarters 'tween decks, one with restaurant in hold and galley on 'tween deck; one for engine room and one for boiler room.

The main deck extends the full width of the boat, with steel engine and boiler castings located on the center line and on either side driveway for wagons, autos, etc. On the outboard side, forward and aft of the paddle boxes, there are seats for about 168 passengers. Forward of the house at each end is located a combined hand and steam capstan. The steam steering engine is located below the pilot house so that the transmission will be as direct as possible. The men's toilets, crew's wash room and bar are also located on this deck directly adjacent to the wheel houses. The accommodation for the crew is on the 'tween deck and ample space is provided for two cooks, four firemen, two oilers, ten waiters and ten sailors, including berths, mess tables, lockers, etc.

The restaurant is located on the 'tween deck on the opposite end of the boat and is reached from the main deck by a broad stairway. A double counter of mahogany with a foot rail and stools extends around three sides of the room, there being tables for the accommodation of ladies. The galley is equipped to give passengers a quick and efficient service. The restaurant color scheme is white and gold, the same as the saloon, with mahogany trim. The upper or saloon deck is reached by four broad stairways at the corners of the deck house. The enclosed portion of this deck extends the full width of the boat and about 96 ft. in length. There is an open section at each end with a glass partition on center line of boat under the pilot house that acts as a wind break. The seating capacity is about 414 in the closed section and 200 in the open sections, the seats being made of mahogany with life preservers stowed under each seat. The painted wood work is finished in white and gold, the window frames and all trim in natural mahogany. Above the saloon is a dome or trunk skylight, glazed with art glass.

On the hurricane deck are located the pilot houses and officers' quarters, to accommodate captain, chief engineer, two mates and two assistant engineers.

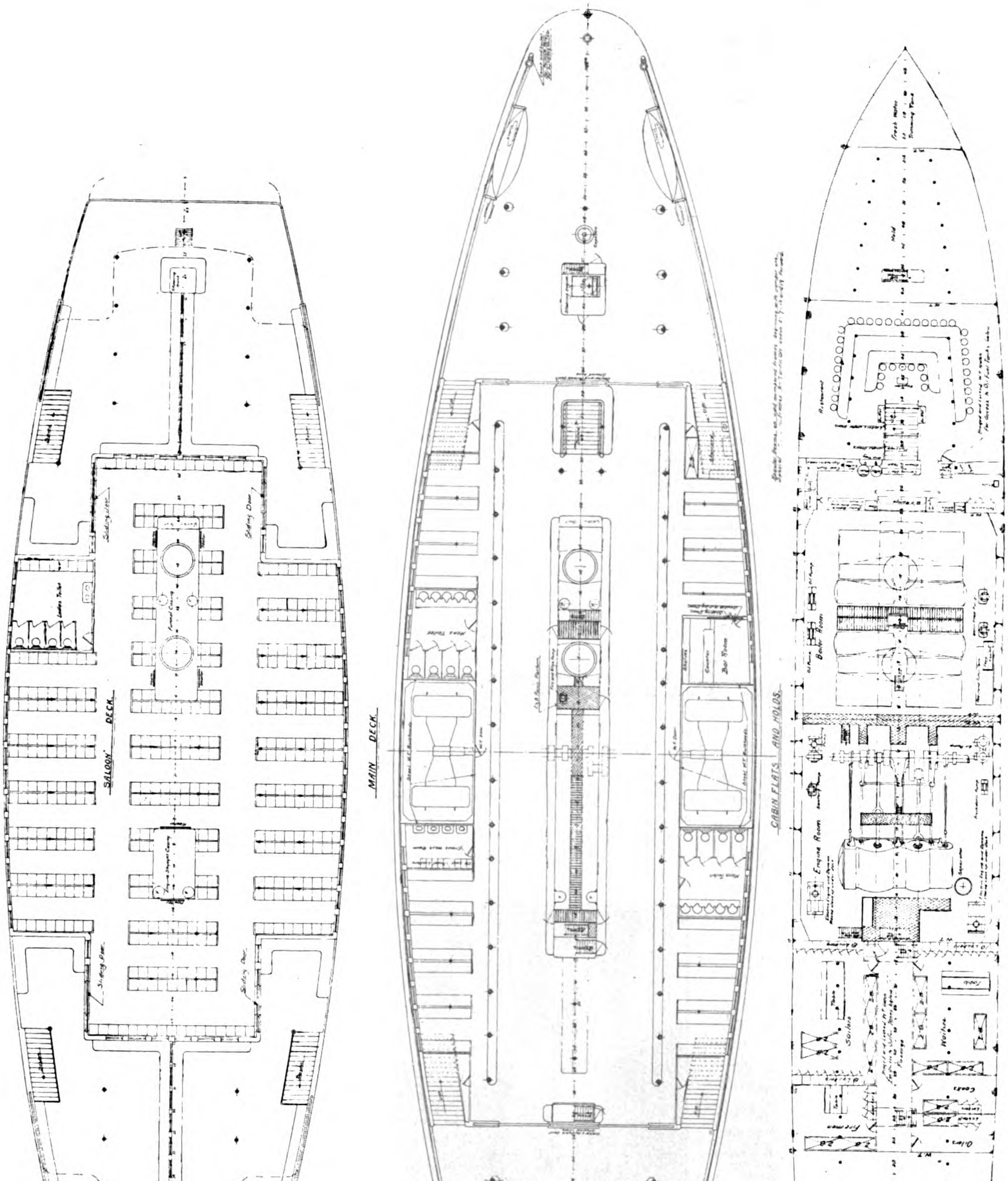
Steam radiators are located throughout the boat wherever necessary.

The fire protection includes ten six-gallon extinguishers, 50 buckets stowed in bucket racks and ten fire axes hung in racks.

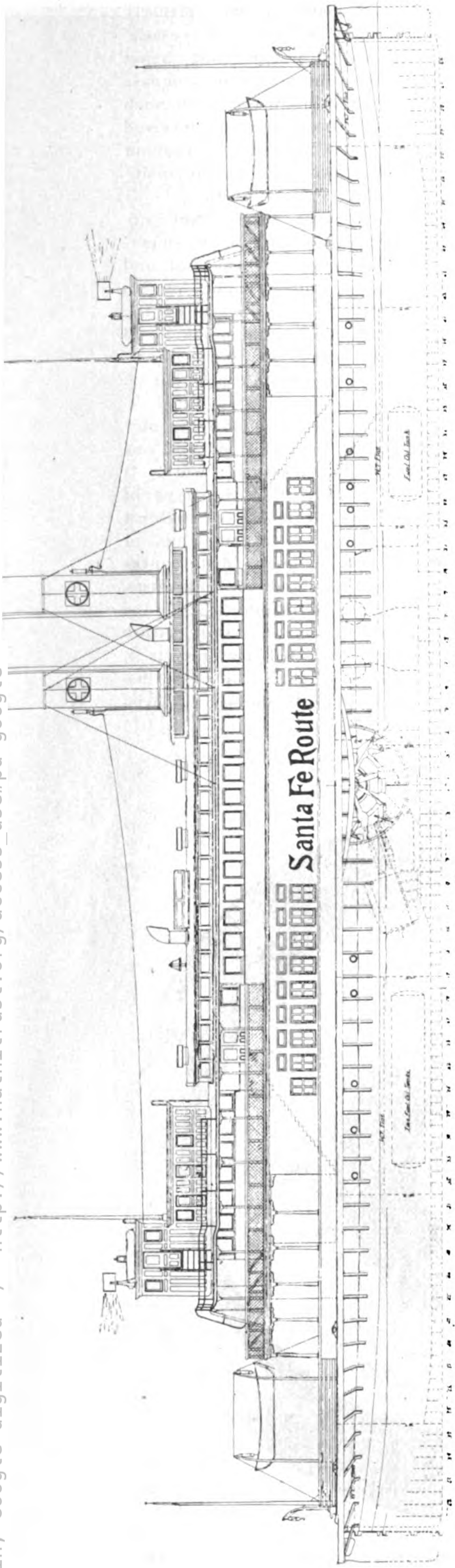
Four life-boats, 20 ft. long, 6 ft. wide and 2 ft. 6 in deep, are hung in davits, two forward and two aft on the main deck, and equipped in accordance with the United States steamboat inspection laws. Fifteen hundred life preservers are stowed under the seats in the saloon and in racks on the main deck.

A 1,200-lb. stockless anchor is stowed at each end of main deck, together with 75 fathoms of 1⅛-in. close link chain.

The engine is of the compound inclined type with cylinders 38 and 77 in. diameter, 66-in. stroke. With steam at 150 lb. and at 40 r. p. m., the engine is designed to develop 2,000 i. h. p. What is believed to



SALOON, MAIN DECK AND HOLD PLAN OF THE FERRY SAN PEDRO.



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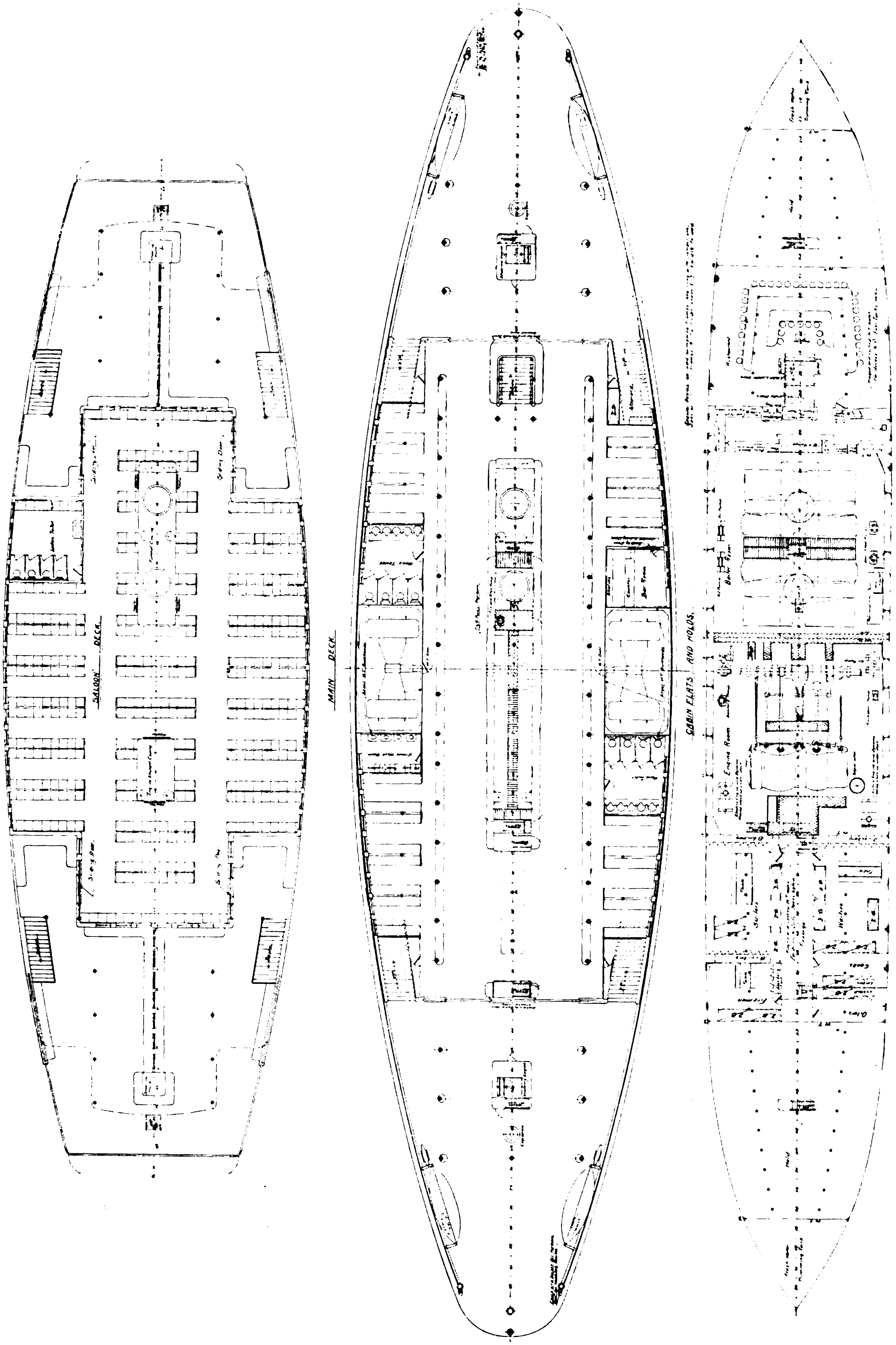


SALOON, MAIN DECK AND HOLD PLAN OF THE FERRY SAN PEDRO.

be a new departure in valve gear has been incorporated in this design, and is practically a combination of the Corliss gear with poppet valves, operated through a wrist plate by eccentrics on the main shaft, there being two steam valves and two exhaust valves on each cylinder. The steam valve cut-off gear is operated by a trip motion connected with the cut-off eccentric on the main shaft and the exhaust valves by a direct connection from the wrist plate. The cut-off gear is operated from the starting platform and may be varied from 25 to 80 per cent, as required. The wrist plates are driven from link gear fitted with steam reverse. The condenser is of the surface type of cast iron box shape and forms a seating for the main crank shaft bearings. The cooling surface is 3,972 sq. ft.

The auxiliaries include an air pump of the independent beam type, 12 in. x 20 in. x 12 in.; two boiler feed pumps, 10 in. x 6 in. x 18 in.; fresh water pump, 3 in. x 3 in. x 3 in.; one fire and bilge pump, 12 in. x 10 in. x 12 in.; one direct-driven 12-in. centrifugal circulating pump, and two duplex oil pumps, 6 in. x 5 in. x 10 in.

The paddle wheels are of the feathering type with cast iron centers. The arms, rings and braces are of forged steel and the floats are of plate steel, 11 in. thick, with cast steel trunnions. The eccentric pin is carried on the sponson in the usual manner. The general dimensions of the wheels are as follows: Outside diameter of rims, 20 ft. 6 in.; diameter to center of floats, 16 ft.; size of floats, 10 ft. x 3 ft. 6 in. x 1 in.; No. of floats, 8; revolutions per minute, 40.

The boiler equipment consists of four Babcock & Wilcox water-tube boilers, having a total heating surface of 9,332 sq. ft. and 252.8 sq. ft. of grate surface, fitted to burn crude oil. The working pressure is 150 lb. per sq. in. Three fuel oil tanks, 6 ft. diameter, 20 ft. long, are located in the holds forward and aft of the engine and boiler rooms.

Salving the Northwestern

SEATTLE, Dec. 19.—One of the most interesting salvage contracts executed on the Pacific coast in months was completed a few days ago when the big Alaska liner Northwestern steamed into Seattle harbor with her bow enclosed in a cofferdam covering a seriously damaged stem. The big vessel came into port for drydock and repairs after having lain exposed to the elements for eight days. Extreme haste was necessary in taking the vessel off and it is considered good luck that this was accomplished. At first the task seemed hopeless, but good weather favored the salvors and by strenuous effort they were successful. The place of the stranding is exposed to a great sweep from the south from which direction the worst winter storms rage on Puget Sound.

Surveyed in Heffernan dry dock, Seattle, it was found that the Northwestern's repairs will include renewing 36 plates, removing and fairing 15, replacing 60 ft. of the keel which was carried away, rebuilding the stem which was torn off, renewing 30 floors and frames and repairing other portions of minor importance. The contract has been awarded to the Heffernan Dry Dock Co., of Seattle, time 45 days.

Bound from Seattle for Southwestern Alaskan ports, the Northwestern was first en route to Nanaimo, B. C., and consequently she was making her way through the San Juan group of islands in the northern part of Puget Sound. She stranded at 2:40 a. m., Dec. 2, the weather being dark and showery but without fog. She took the ground in False bay, San Juan Island, going full speed, bringing up finally with her stem against the cliffs, breaking the stem bar and crumpling up her shell plating. At the time the tide was about half flood and the tidal range 10 ft. The vessel's draught was 19 ft. 5 in. aft and 14 ft. forward. At high water she lay aground for a distance of 50 ft. forward, from which point the water gradually deepened to 8 ft. under her heel, at low water the heel taking the ground. She was full of water forward, which included forepeak and No. 1 hold. The after hold, engine and boiler rooms were not leaking and thoroughly dry.

Having spent practically the entire year on the Pacific coast supervising various salvage operations, including the raising of the steamers Yucatan, Georgia and Princess May, in Alaskan waters, it was appropriate that Capt. W. H. Logan, special agent for the Salvage Association of London, should be on hand to perform similar service for the Northwestern. Associated with him was Capt. S. B. Gibbs, representing the San Francisco Board of Underwriters. The British Columbia Salvage Co.'s salvage steamer Salvor was one of the first vessels at the scene and after some negotiation the representatives of the underwriters contracted with H. F. Bullen, manager of the salvage company, to float the vessel and deliver her in

BOW OF STEAMER NORTHWESTERN, STRANDED ON FALSE BAY, SAN JUAN ISLAND, PUGET SOUND, TAKEN IN HEFFERNAN DRY DOCK, SEATTLE.

Seattle harbor for the sum of $16,000, with $5,000 as a minimum in case of failure. Although under British registry, the Salvor was allowed to work at this wreck, which, although it lay on the American side, was in contiguous waters.

Upon examination the diver found the stem jammed hard against the cliffs, while the fractured shell plating, floors, frames and stem bar were hanging to several boulders. The stem bar was broken and bent to the 15-ft. mark, a portion of the keel bar gone, about 20 shell plates crumpled up, several hold pillars bent, as also were the orlop deck beams. Otherwise the vessel was intact except the bulkhead dividing the forehold and fire-room, which was leaking slightly. The bottom sloped away on a 5 or 6 per cent grade from a point about 50 ft. aft of the stem, the vessel's heel being 8 or 10 ft. from the bottom (high tide). A ridge in the gravel showed that the vessel grounded aft at low water. Propeller, rudder, stern frame and shell plating were undamaged to a point 50 ft. aft of the stem. From this point forward, the entire bottom was badly fractured.

After further examination and consideration, it was decided to construct a cofferdam or platform completely covering the damage, sufficiently strong and well shored to take the vessel to Seattle. The plan also included the installation of three 10-in. pumps in forward hold, the discharge of all cargo, and, if necessary, the moving of the bunker coal from the 'tween decks to the after end. The construction of the cofferdam, installation of pumps, laying out of heavy anchors astern and discharge of cargo were carried on at the same time. By Dec. 8, all cargo was out of the vessel, dry and in good condition, and forwarded on steam lighters. The quantity was about 350 tons. The anchor used was 4-ton weight with 120 fathoms of 5-in. wire hawser, laid three points on the starboard quarter. On Dec. 8 the cofferdam was completed and about 150 tons of coal from the side bunkers had been moved to the extreme after end of the 'tween decks. The construction of the cofferdam was carried on under difficulties as, owing to a short swell caused by continued strong southeasterly winds, and the vessel's stern rising and falling with the tide, the bow kept crushing down over the rocks, altering its shape and increasing the damage.

The first effort to float the vessel, Dec. 8, was unsuccessful, although a heavy strain was taken on the stern cables, the ship's main engines going full speed astern and the tug William Joliffe towing. This attempt proved that the Northwestern still bore too heavily on the rocks forward.

It was then decided to both lighten and tip the vessel. Lack of space made it apparent that heavy materials were needed to put her down by the stern. No heavy weights being left aboard, 150 tons of gravel were ordered. Coal estimated at 150 tons, was jettisoned from the forward bunkers. When this coal was over the side a second effort to float was made Dec. 9. This was also unsuccessful and more coal was jettisoned from the forward cross bunkers. The gravel was then hauled aboard. After careful consideration it was determined to flood the after hold to insure the vessel's floating Dec. 10, as further delay was dangerous. The tides were falling off rapidly and it was feared that unless the Northwestern was taken off that day, nothing more could be done until the next spring tides, about Dec. 18. Therefore about 200 tons of water were pumped into the after hold.

On Dec. 10, with the tug William Joliffe fast alongside, and the U. S. revenue cutter Snohomish with a hawser to the Northwestern's stern, a strain was taken on the vessel's stern anchor cables and she was drawn clear by the purchase exerted on her own anchors. The tug took her one length astern and held her until she was clear of all moorings. Then the Northwestern proceeded the seventy miles to Seattle, under very slow speed, as it was feared that the grinding on the rocks had strained the cofferdam. She was convoyed by the tug and arrived safely. This is the Northwestern's (ex Orizaba) second close call from total loss, as she ran aground in Southwestern Alaska in the summer of 1907 and was salved only after great effort.

Launching the General Hubbard

The Craig Ship Building Co., Long Beach, Cal., launched the lumber freighter General Hubbard for the Hammond Lumber Co., of San Francisco, on Saturday, Dec. 3. The General Hubbard is the largest vessel ever launched in southern California. The newspapers in their accounts stated also that it was the first side launching to take place on the Pacific coast, but this, however, is an error. The whaleback steamer City of Everett, built by Alexander McDougall at Everett, Wash., was the first side launching on the Pacific coast. The steamer is 266 ft. over all, 42 ft. beam and 19½ ft. deep. Her engines are triple expansion with cylinders 19, 32 and 51 in. diameters by 36 in. stroke, supplied with steam from three Scotch boilers, 11 x 11 ft. The Hubbard is fitted as an oil burner. The Craig Ship Building Co. is also building a passenger and freight steamer for the Swayne-Hoyt Co., of San Francisco, to be named the Navajo. John F. Craig, the head of the company, is a son of John Craig of Toledo, O., and was formerly connected with the Craig Ship Building Co., of that city.

A charter has been issued at Charleston, W. Va., to the Pittsburg & Cincinnati Packet Co., of Pittsburg, with a capital of $100,000. The newly organized company will take over the property of the former Pittsburg-Cincinnati packet line, which went into the hands of receivers recently.

STEAMER GENERAL HUBBARD IMMEDIATELY AFTER LAUNCHING.

SHOP ORGANIZATION OF A LARGE WOOD-WORKING SHOP AT A NAVY YARD

BY HOLDEN A. EVANS, NAVAL CONSTRUCTOR, UNITED STATES NAVY.

IN previous issues of THE MARINE REVIEW, the conditions and the steps taken to reduce costs and increase output in a large navy yard blacksmith shop were fully described. Similar methods have been employed in the wood-working shop, sheet metal shop, sail loft, flag shop, and other shops, with equally satisfactory results. While the same principles have governed and the same general methods have been followed, the details vary to meet the special requirements of each shop.

The reorganization of the shops under my supervision has been carried out under the usual government restrictions and limitations. An additional handicap is that it has not been possible to give a money reward to the workmen for good results accomplished. I endeavor, however, to give for efficient service such rewards as are possible. In some navy yard shops there are wide fluctuations in the volume of work, and large reductions in the force are frequently necessary. In the past these reductions have been made by the foremen, and in some cases other considerations than efficiency have no doubt governed. Whether true or not, the men have believed that efficiency had little to do with retention and, under these conditions, the result is sure to be lack of effort on the part of the workmen and lack of efficiency. By the methods adopted the output of each man is recorded, and when a discharge becomes necessary those least efficient, as shown by these records, are laid off. The men soon learned that efficient service is rewarded in this manner, and this is at least a small incentive to better work, and in some cases is sufficient to produce large reductions in cost. These methods also bring deserving men to the attention of the management, and these are promoted whenever possible. In other words, every reward possible under the day work system is given for efficient service.

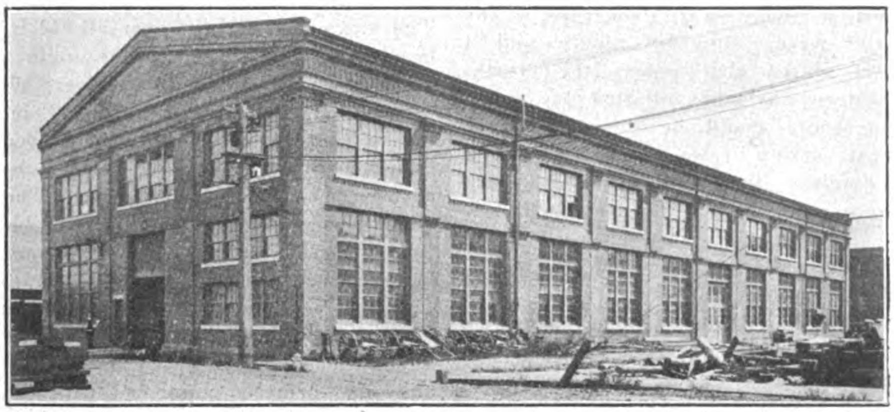


FIG. 1—EXTERIOR, JOINER SHOP, MARE ISLAND NAVY YARD.

I believe it a mistake to take a shop where the output is low and attempt to immediately introduce any other system by which the men are paid for the work actually accomplished. The men have been so long accustomed to low output that the standard times set or the piece work rates will seem unreasonably low, and they will make no attempt to earn a premium or bonus and will refuse to work piece work.

Before any attempt should be made to change from the day work system, the shop should be improved and the best or nearly best possible under the day work system obtained. The shop facilities should be made right; waits for tools, material, drawings, etc., should be eliminated and a proper routing system established. In other words, the shop should be run on scientific principles and the mechanism of the system should be in good running order before changing from day work.

In the navy yard shops to which I refer, it is this preliminary work which has been accomplished. The next logical step is to change the method of payment of labor so as to reward the efficient and to hold out to all sufficient money incentive to induce each to put forth his very best efforts.

In describing the organization and methods of the joiner shop it must be remembered that the shop is still operated under the day work plan and that consequently the best results are not obtained. The shop is, however, in the condition that it is ready for the change either to the premium or bonus system, and no change in organization will be required—only

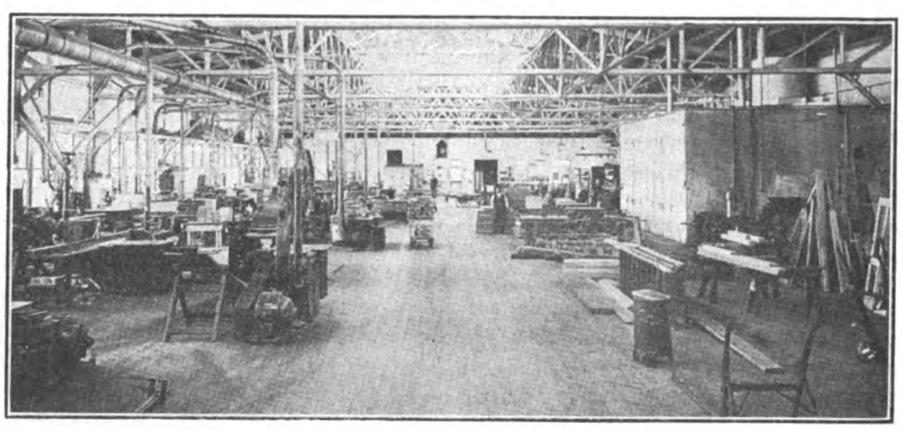


FIG. 2—UPPER FLOOR, JOINER SHOP, LOOKING EAST. NOTE EXCELLENT LIGHTING AND ABSENCE OF SHAFTING AND BELTS.

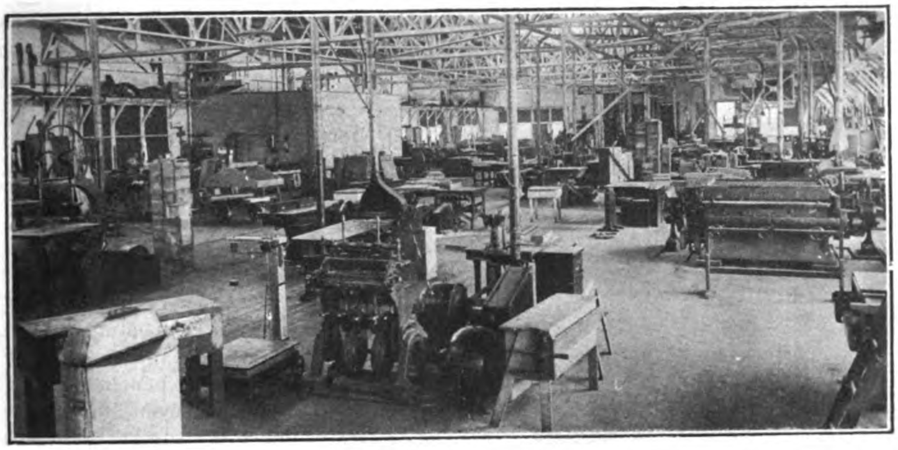


FIG. 3—ANOTHER VIEW OF UPPER FLOOR, JOINER SHOP.

there will be large losses due to the outside force not receiving the shop work in the proper order and at the proper times, or to the outside force doing work by hand which should be done in the shop.

Losses Due to Men Going to the Shop.

The force, therefore, naturally divides itself into three general groups, viz., ship work, buildings, and shop work, with an assistant foreman in charge of each division.

All material for the two outside divisions, whether rough or dressed lumber, finished furniture, hardware, or other material, is obtained through the shop and furnished where required. The workmen are not allowed to go to the shop for this material.

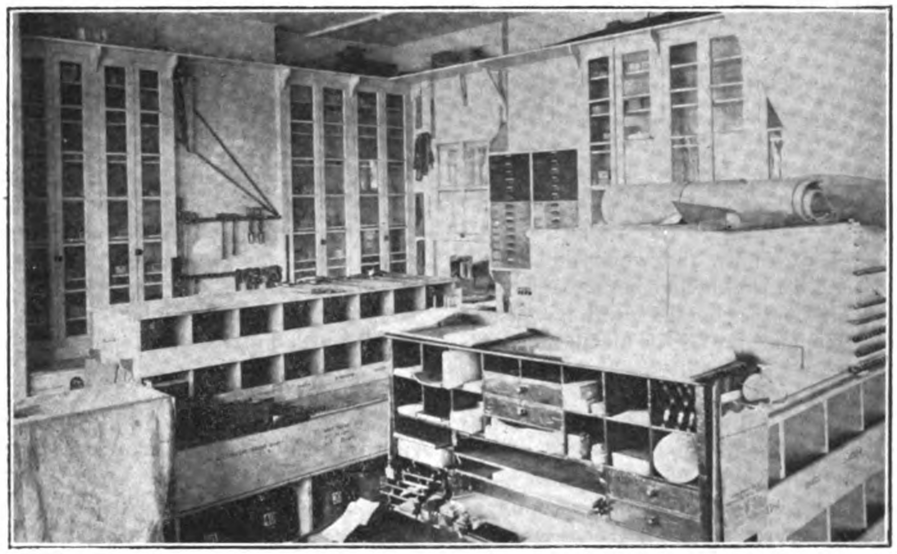


FIG. 5—A CORNER IN TOOL AND STORE ROOM, LOOKING TOWARDS DELIVERY WINDOW. ALL MATERIAL IS INDEXED. STOCK OBTAINED FROM GENERAL STORE ROOM AS REQUIRED.

slight modification of details will be necessary.

Organization of a Large Navy Yard Joiner Shop.

The joiner work at a large navy yard comprises not only the usual shop work, but also ship work and work on buildings. The greater part of the work outside of the shop is on ships. Practically all of this is special and, due to the small openings through which the work must be carried for installation, it must be erected in small sections, necessitating more work than would otherwise be required. Very little ship work is what might be called rectangular; nearly all is beveled on account of the sheer and crown of the decks. This makes the work costly, not only in the shop but also in erection, as much hand work is involved.

Owing to these conditions a good organization is required to bring about co-operation between the outside and shop forces. If this is not obtained

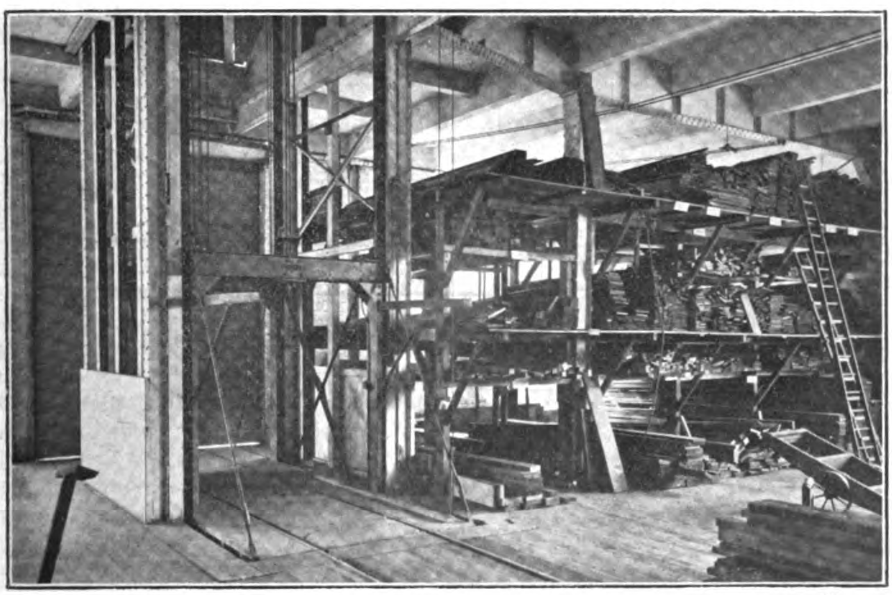


FIG. 4—SECTION OF LOWER FLOOR, JOINER SHOP, SHOWING MATERIAL RACKS AND ELEVATOR.

Before the present organization was perfected much time was lost by workmen going to and from the shop. As in a large navy yard, ships are often berthed at considerable distance from the shop, much time can be lost by men going to the shop. With the ordinary workman there is little looking ahead, and it is more often the case than otherwise that he only sees that he requires shop work when he gets to the point where he must stop until this work is obtained, when he goes to the shop to make known his needs and wait for the work, or perhaps to hunt up the material and machine it himself. This may seem an exaggerated case, but, unfortunately, it, and similar cases, were of frequent occurrence before the work was systematized. Each man planned his own work, and he also wished to

do it all, including selecting and machinery, the material and erecting it on the ship, and even carrying it to the ship on a push cart, assisted by the joiner who worked with him and several helpers. As found in all classes of shops, the work was rarely planned before being undertaken, and nothing was provided until its necessity stopped the work until obtained.

For these conditions the organization developed provided:

(1) Careful analysis of the work to be accomplished.

(2) Division of the work into natural elements. Written instructions as to the work required; each class of work to be done by men specially trained for this class.

(3) Collection of drawings and information required by each division to enable it to accomplish its work.

(4) Collection of the material required and its delivery to the proper division at the right time.

(5) Assembly of the finished material and delivery to the outside force when needed.

Description of Shop.

The shop itself is well equipped, as can be seen from the photographs Figs. 1 to 6. The building is well lighted and ventilated and equipped with an efficient dust collecting system. Excellent wash and toilet rooms are provided. Modern machinery is installed, driven by individual motors and obviating the usual mass of belting and shafting. In fact, every physical condition is met for good work at low cost.

The shop work naturally divides itself into the following five divisions:

(a) Rough machine division, comprising heavy band sawing, resawing, planing, and matched material and molding in quantities. This division takes in the lower floor of the joiner shop and the saw mill. The greater part of the material manufactured in this division does not go to the finished machine division on the upper floor of the joiner shop, but is generally the product of a saw mill and planing mill, and is finished material when it leaves this division.

(b) Finished machine division, comprising work done on the upper floor, as light re-sawing, rip sawing, dovetailing, mortising, tenoning, shaper work, light planer work, etc.

(c) Carpenter division.

(d) Joiner division.

(e) Cabinetmaking division.

The last three cover bench work and minor incidental machine work, and the limits of the work of each division are shown by the designations. While it is desirable that the great mass of the machine work should be done by expert machine hands and not by the bench men, if the bench men are prohibited from using the machine tools excessive hand work will result. Rip and cut-off saws, band saws and buzz planers are conveniently placed to the benches and the bench men are allowed and required to operate these as necessary, but supervision is exercised to check any tendency of the bench hands to get into work which should be done by the machine division.

Ordering and Routing Work.

All work is ordered either by means of a job order or a shop order, the latter being based on a job order is-

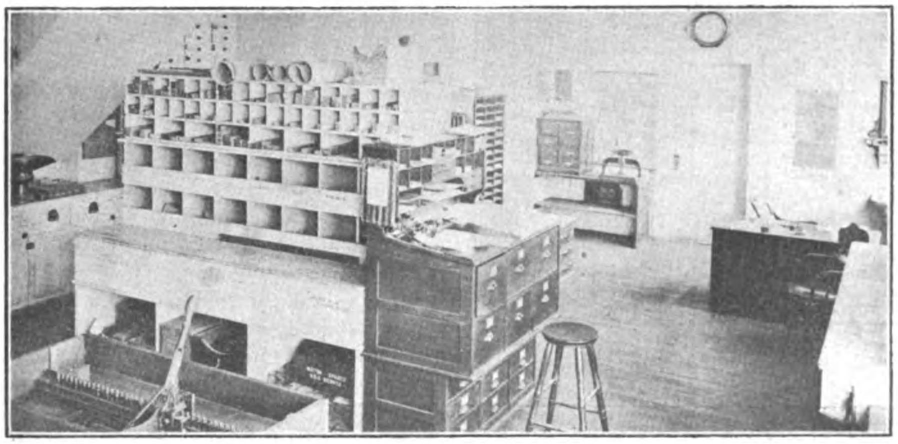


FIG. 6—JOINER SHOP STORE ROOM. SMALL QUANTITIES OF MATERIAL IN GENERAL USE ARE KEPT FOR IMMEDIATE ISSUE.

Job Order No. 2901/N Title Z Sub-Title Issue

Appropriation Naval Supply Gen'l Head Morris Tube Outfit

NAVY YARD, MARE ISLAND, CAL.,

April 2,1910

Sir:- You will please
Make and turn into store
5 Morris Tube Outfits, complete for 4" mount MK.111, Mod. 111.

2 Morris Tube Outfits, complete for 4" mount MK.V11, Mod. 1V

	ESTIMATED COST	ACTUAL COST
Labor	$520	
Material	250	
Indirect	170	
Total	$940	

Authority GSK Req. #1518-E., Rec. 3246 of 3/24/10.

Date of Completion

To Mach. #3.

Respectfully,
H. A. [illegible]

To be returned to office upon completion of work

FIG. 7—JOB ORDER, ISSUED FROM MAIN OFFICE.

sued to another shop. The job order is issued from the main office and is shown in Fig. 7. The shop order is

MFG. DEPT. 1101. NAVY YARD, MARE ISLAND, CAL.

SHOP ORDER. 4-7-10

OUTPUT ACCOUNT.

JOB ORDER NO. 2901/N APPROPRIATION Naval Supply

TITLE J SUBTITLE Issue GENERAL HEAD Target frames

TO Joiner SHOP.

You will do the following work charging labor and material, as above:

Furnish labor & material to make 14 target frames as per plan No 6565.

WORK SHOULD BE COMPLETED BY 4-11-10

J. A. Payne

FOREMAN Machine SHOP.

ORIGINAL AND DUPLICATE TO BE FORWARDED TO SHOP IN WHICH WORK IS TO BE DONE. FOREMAN RECEIVING ORDER WILL PUT IN DATE OF RECEIPT AND DATE ON WHICH WORK WILL BE COMPLETED, RETAIN ORIGINAL AND IMMEDIATELY RETURN DUPLICATE. WHEN JOB IS COMPLETED FOREMAN DOING WORK WILL FILL IN ACTUAL DATE OF COMPLETION AND FORWARD TO SHOP THAT ISSUED THE ORDER AND IF WORK IS SATISFACTORY ORDER WILL BE INITIALED AND RETURNED TO THE FOREMAN WHO DID THE WORK.

ORDER WAS RECEIVED 4-7-10, AND THE WORK

WILL BE COMPLETED 4-11-10 FOREMAN R.H.

WORK ACTUALLY COMPLETED 4-11-10 FOREMAN R.H.

IS WORK SATISFACTORY? The above work is Satisfactory

J. A. Payne FOREMAN

FIG. 8—SHOP ORDER, ISSUED BY ONE FOREMAN OR ANOTHER BY AUTHORITY OF A JOB ORDER.

issued by one foreman, by virtue of a job order which he holds, on another for incidental work, and is shown in Fig. 8.

All job orders and shop orders go to the foreman's desk and he gives each his personal attention. He notes on the back of each, in a form provided, the assistant to whom the work is assigned, the kind and quality of material to be used, and any special instructions or information which he deems necessary to enable the job to be carried through expeditiously and economically. The order then goes to the route man, who makes the instruction cards. For outside work these go to the designated outside assistant. He investigates the job, orders the material, makes orders on the shop for necessary machine work, and details the outside man for the job, entering a standing order slip and placing it on the standing order board under the man's check number. The work ordered from the shop follows the shop routine. For all shop work for the outside force the route man makes out the instruction card, Fig. 9, and the order for such material as is not carried in the shop store. The instruction card goes to the gang boss on the shop floor. From his knowledge of the work and an inspection of the standing order board, which shows the assignment of every job ordered, he can tell where the new work can best be placed. He assigns the joiner who is to lead on the job and such men as are necessary to assist him. The man who is to lead gets the original instruction card, while those who are to assist get cards giving the charge number and the name of the man leading on the job.

The leading man on a job when he receives a new instruction card, sizes up the job and orders the necessary machine work on a machine card, Fig. 10. After filling out this card he hangs it on a hook on his board and it is taken up by the material man, who obtains from the route man copies of the orders for material and receives and checks this material. He also obtains from the shop store all minor material needed. When the rough material is received it is rough machined and sent to the bench for laying out, and then delivered to the various special machine men for such operations as dove-tailing, turning, shaping, mortising, etc. The machine card shows the sequence of these operations and follows the material through the shop until it is returned to the bench ready for assembling.

There is a well stocked shop store, Figs. 5 and 6, from which such material as hardware, sand paper, locks, nails, etc., is issued. A moderate amount of lumber is kept stored in racks in the shop for immediate issue. All of this material is accounted for on stock cards, and all issues are charged to the jobs. The shop store is replenished from the general store.

MFG. DEPT. NO. 223

CHECK NO. 1828 M. Payson. JOB ORDER NO. 2901/N

ARTICLE Target frames

ISSUED 4-7 1910 COMPLETED 4-11 1910 BY

INSTRUCTIONS

Make 14 target frames as per plan No. 6565

Ship to Machine shop #3

DATE	RT	HR	DATE	RT	HR	DATE	RT	HR	DATE	RT	HR	DATE	RT	HR
4-7	56	3	4-11	56	5									
4-8	"	8	4-11	21	5									
4-8	21	8												
4-9	56	8												
4-9	21	8												

FIG. 9—INSTRUCTION CARD, ISSUED TO THE WORKMAN.

J. O. NO. 2901 MACHINE DIVISION. DATE 4-7 1910

Check No. 1828 Sections

No.		No.		No.		No.		No.	
1	Rough Machg.	2 Bonny	Turning	3 Blanco	Resaw	4	Shaper	5	Sticker
	Barge Lumber		Tenoning		Cut off		Scroll Saw		Sander
	Mouldings		Mortising		Planing		Panel Mach.		Dovetlr
	Dressing		Boring		Jointing				

Section	Quantity	Kind	Machine to the following sizes and	Forw'd to Section Div	Bench
2	28 pcs	O.P.	17" long, dressed 1½" x 1½	Jones	4
3	28 "	O.P.	13" " " " 1½ x 1½		

Blanco Material man
Check No 1843

FIG. 10—MACHINE CARD, BY MEANS OF WHICH MACHINE WORK IS ORDERED.

Instruction Card Holder.

At each bench there is a metal holder, shown in Fig. 11, with three pockets which hold the instruction cards. The card at the top is the job on which the man is working, the second is for the job for which the material has been collected, and the third pocket holds the cards for jobs ahead for which material and information is being collected. When the instruction cards were first issued the men did not take kindly to the system, principally because it was a change for which many of them did not see the necessity. It was found that cards were misplaced and often could not be found. This caused confusion and annoyance, and it was suggested that the back of each holder be painted in bright red "Out of a job." This effected an immediate remedy and no more cards were lost, for the card was needed to cover the red "Out of a job" sign. It also received an even more useful purpose, as it kept the men supplied with jobs or if there were too many men for the work in hand, brought about an immediate reduction in the force, as the gang boss could not afford to have the "Out of a job" sign displayed, even from the bottom holder.

On the board carrying the instruction card holder are hooks for the time cards, on which each man records the time he works on each job, a separate card being used for each job. They are sent to the main office each day and from them the pay roll and the cost records are made.

Promises of Completion.

All shop orders and many job orders require promised dates of completion. The shop order shown in Fig. 8 shows clearly the methods followed. When promises were first required they meant little. Promises were made without investigation and little effort was made to keep them, and far more promises were broken than kept. These conditions were gradually improved and when conditions were fairly satisfactory the black list board was established. This is a blackboard, shown in the left of the photograph, Fig. 12. It contains first, under the heading "Today's Important Business", a list of all of the orders which the joiner should finish on that day, and a list of all orders which have been promised to the joiner shop by other shops for the day. Below this, under "Orders on Black List," is given a list of the orders on which the joiner is overdue and orders which are overdue from other shops.

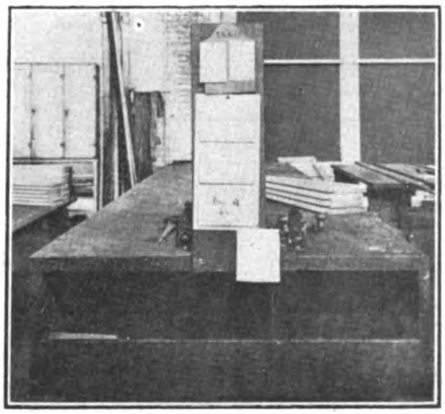


FIG. 11—WORK BENCH AND INSTRUCTION CARD HOLDER.

There is a board similar to this in each shop. These boards are corrected each afternoon between 4 and 5, and the foremen who are delinquent are notified by telephone, and the shop superintendent is informed. Sometimes there is good reason for the delinquency; material to be purchased overdue, a defective casting, changes made in the work, etc., and in these cases the shop superintendent authorizes the removal of the delinquency and a new promise date. The promise board and the black list have made promises of value. Dependence can now be placed on these promises and the work can be properly planned.

The standing order, or work board,

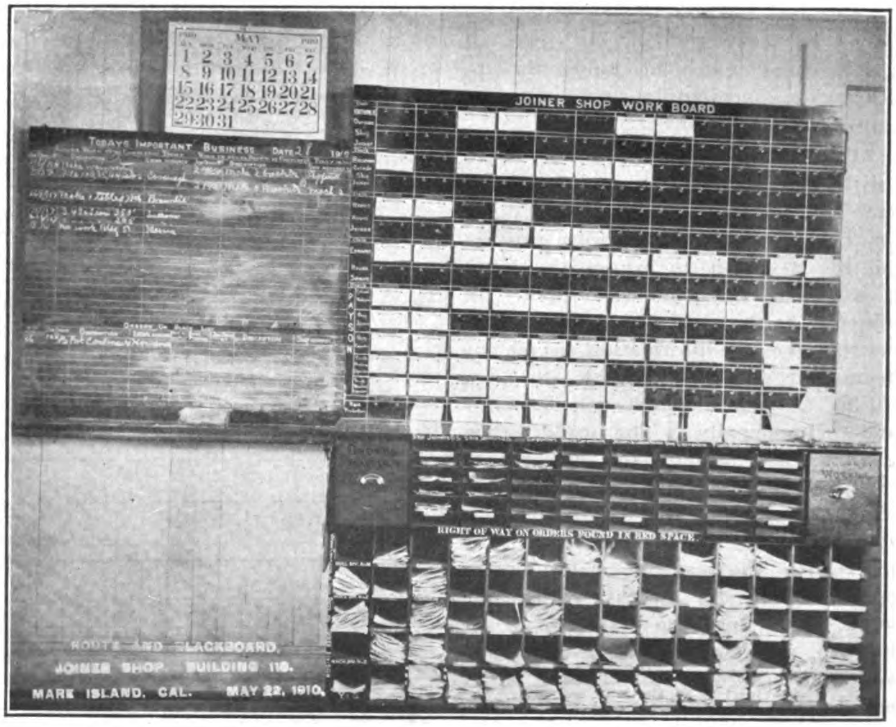


FIG. 12—JOINER SHOP WORK BOARD AND FILES ON THE RIGHT. TICKLER BOARD, SHOWING IMPORTANT BUSINESS AND PROMISES DUE ON THE LEFT. BLACK LIST FOR OVERDUE PROMISES.

is shown on the right side of the photograph, Fig. 12. This board shows the men assigned to each gang boss or division, and the work assigned to each man. If any change is made in the status of a man or a job it must be immediately shown on the board. By means of this board the foreman, each gang boss, and the route man, can tell exactly the location of all work in the shop, and can readily assign new work.

Below the board proper are pigeon holes for the various divisions, where all orders and instructions are placed. Urgent orders have pink slips attached to them and are placed in the red spaces. The heads of outside divisions are required to visit this board at least once in the forenoon and once in the afternoon to make the necessary changes and to obtain new orders.

All job orders and shop orders, and instructions relating thereto, are filed alphabetically in the two files, "Orders waiting," and "Orders working." In the latter are placed orders on which work is proceeding, and in the former work ordered, but not under way, due to the ship being absent from the yard, or other similar reason. Whenever any work becomes inactive the order must be changed from the active file to the inactive.

In work which is repeated, detail records are kept of the time and cost of the various operations, and these are carefully analyzed and studied to determine where cost can be reduced. Since the adoption of the system outlined, large reductions have been made in costs. In work that is repeated the costs have in nearly all cases been cut in half, while in some cases the reduction has been even greater. A large number of well finished hardwood boxes, called "ditty boxes," are manufactured. Each enlisted man aboard ship is entitled to one of them, in which he stows his trinkets, letters, etc., and it also serves as his writing desk. A few years ago these cost to manufacture over $5.00 each, and they are manufactured to-day for about $2.00 each, although the cost of labor and material has advanced. This is typical of many other similar reductions in costs. These items, while they appear small, are in the aggregate large. On the order for three new ships, 2,500 ditty boxes were required and owing to better methods a saving of $7,500 was effected.

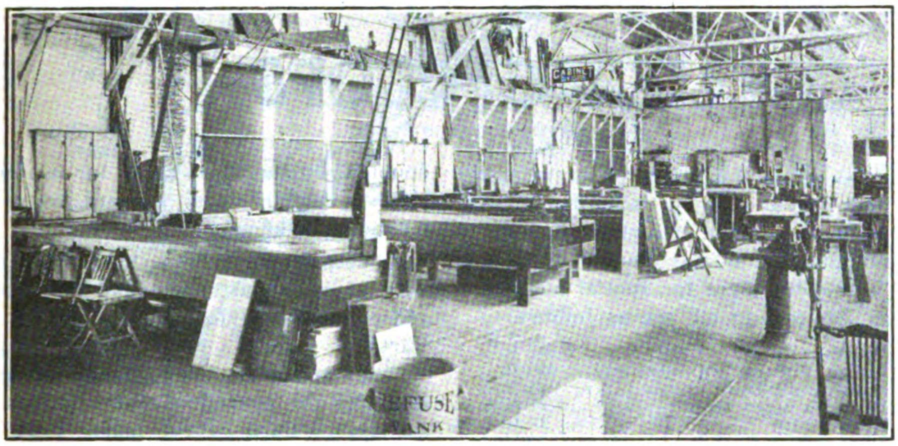


FIG. 13—CABINET DIVISION, JOINER SHOP.

While the saving on general work has not been as great as on the duplication work, it has, however, been large, and the results fully justify the study, time and expense that have been expended in organizing the shop and systematizing the work.

Launching Steamer Corozal

The steamer Corozal, launched at the yards of her builders, the Newport News Ship Building & Dry Dock Co., is the first of three steamships now building for the New York & Porto Rico Steamship Co., from designs by Cary Smith & Ferris, and will be ready to go into service the latter part of February. The second, the steamer Montoso, will be completed during the early part of March, and the third ship during the summer months.

These vessels will be economical and efficient freight steamships and a fine addition to the large fleet of ships now operated by the New York & Porto Rico Steamship Co. between ports in the United States and the island of Porto Rico.

The steamer Corozal is of the following dimensions: 347 ft. length on deck, 334 ft. 6 in. length between perpendiculars, 46 ft. 9 in. molded beam, 25 ft. molded depth, and has a load draught of 20 ft. She was designed for deadweight service, of the single screw, two-deck type. She has five large cargo hatches, two steel masts with derrick tables, and the forward mast is equipped with 30-ton derrick for handling heavy weights. She also has three large cargo holds, five water-tight bulkheads, 17 cargo booms, and is equipped with 11 winches and complete double bottom for ballast and fresh water tanks.

The steamer Montoso and the third ship are exact duplicates of the steamer Corozal in every way, and all are being built under special survey to class 100-A-1 Lloyds on the improved transverse system of construction.

The propelling machinery of these ships is placed amidships, consisting of a single screw, triple-expansion engine, three single-ended, three furnace Scotch boilers for 190 lbs. working pressure, fitted for natural draft. The main condenser is independent of the main engine; also there is provided an auxiliary condenser plant. The main air, feed and bilge pumps worked off main engine. All other auxiliaries independent.

These ships are provided with steam and hand steering gear, electric light plant, steam windlass and steam capstans and all necessary equipment of this nature to make them most efficient for the service in which they are to engage.

The steamer Corozal, as well as her sister ships, was especially designed for the service in which she is to engage. The plans and specifications were prepared under the direction of Franklin D. Mooney, vice president and general manager of the New York & Porto Rico Steamship Co., by Theodore Ferris, of the firm of Cary Smith & Ferris, naval architects and engineers, of New York, Capt. David Lloyd, J. K. Turnbull, D. A. Whamond and Capt. E. P. McCalder advising the particular requirements necessary for these ships.

Not an Orthodox Freighter.

The adoption of forecastle head, after poop and bridge deck amidships, common to the well-known English tramp ship, is not the case with the new Porto Rico line ships, the forecastle head and after poop being eliminated entirely.

The superstructure for living quarters of the crew is concentrated amidships in two heights of deck houses, thus permitting large deck space forward and aft for carrying large deck cargoes; also large cargo hatches, necessary for the service, placed central

over the cargo holds with the best arrangement of masts, derrick tables and winches placed between the hatches for properly handling the cargo booms, which will rapidly load and discharge these ships both to dock and lighters alongside.

To separate the sailors and firemen from the officers, a small deck house is placed aft for their living quarters, thus giving the crew good and ample ventilation. In the midship house separate mess rooms are provided for the crew to eliminate the necessity of carrying food to the after end of the ships and to concentrate the steward's department work at the galley, which is located in the lower midship house.

In the upper midship house, quarters are provided for the licensed officers; above this is the wheelhouse. The lower midship house contains the petty officers' quarters, mess room for officers and crew, wash rooms, lamp room, ice house, etc.

The steamer Corozal was contracted for with the Newport News Ship Building & Dry Dock Co. to be built and delivered in seven and one-half months, and the steamer Montoso four weeks later. On Oct. 5 the keel of the Corozal was laid, thus showing that the hull and superstructure was built, and the ship launched, in only a little more than 11 weeks' time, which indicates that the Newport News Ship Building & Dry Dock Co. is one of the largest and most efficiently equipped yards in this country for turning out rapid work.

FLEET COLLIER CYCLOPS

THE naval appropriation bill of May 13, 1908, included an item of $3,600,000 for the construction of two fleet colliers of 14 knots sea speed to carry 12,500 tons of coal (including bunkers) one of such colliers to be built at a Pacific coast navy yard.

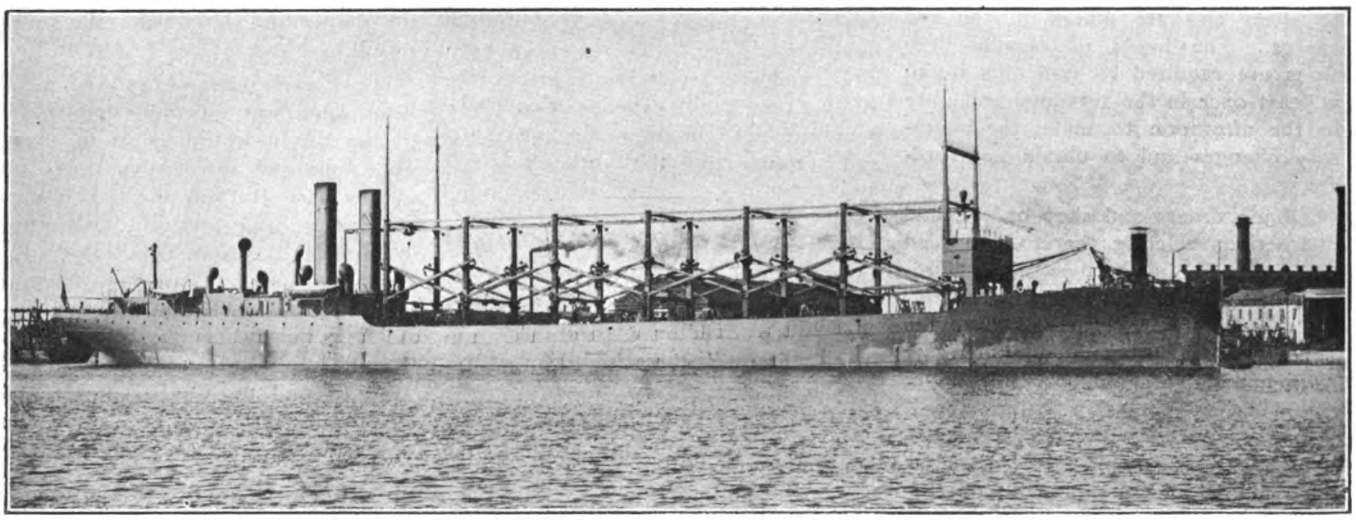
The contract for the other, known as fleet collier No. 4, and named Cyclops, was awarded, on Feb. 3, 1909, to the Wm. Cramp & Sons Ship & Engine Building Co., at a price of $822,500, delivery to be made Oct. 3, 1910. Other bids were also received considerably less than half the amount asked for by the department and which were based on navy yard costs.

The Cyclops was built from builder's design, which, in addition to speed and cargo capacity, provided for handling coal over side at the rate of 1,440 tons per hour.

The leading characteristics of the ship, which is of the twin-screw, single deck type, built in accordance with the rules of the American Bureau of Shipping and classified A-1 for 17 years, plus three for special inspection, or 20 years in all, are as follows:

Length over alll	542 ft.
Length between perpendiculars	520 ft.
Beam molded	65 ft.
Depth to upper deck	39 ft. 6 in.
Draft loaded	27 ft. 6 in.
Displacement at 27 ft. 6 in. draft.	19,360 tons
Coal carrying capacity, total	12,500 tons
Fuel oil capacity	1,000 tons
Gross tonnage	10,644 tons
Net tonnage	6,004 tons

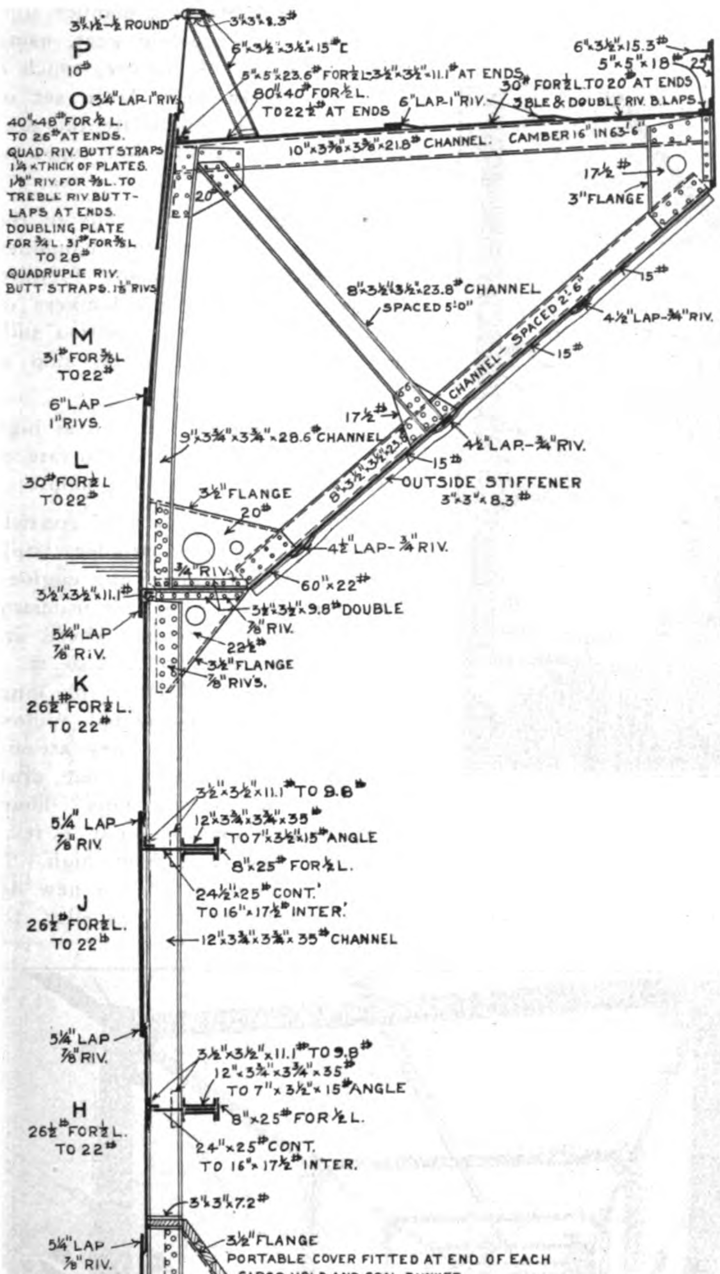
At first sight the Cyclops might be taken for a lake freighter of the type common up to a few years ago with twin smokestacks, and with a superstructure added, but the resemblance is, of course, merely superficial. The cargo space is all forward of the machinery, and is divided into six holds with two hatches 12 ft. 6 in. x 32 ft. in each. The holds are of the self-trimming type with top side ballast tanks fitted between the hatch coamings and the sides of the ship as shown in the midship section. A double bottom, also fitted for water ballast, extends from forward to after peak bulkhead.

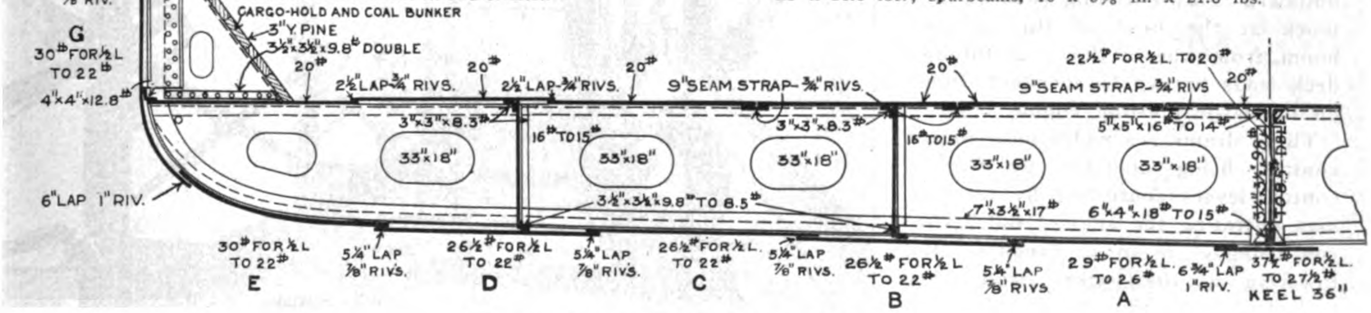


UNITED STATES FLEET COLLIER CYCLOPS.

As seen in Fig. 1, the ship is rigged with 14 steel masts, arranged in pairs and connected by fore-and-aft and athwartship truss ties, eliminating shrouds and stays, and giving a clear deck for the operation of the unloading gear. Each of the masts except those at the ends, carries two steel crane booms, of which the arrangement, rig and method of handling are clearly shown in the accompanying photographs. The unloading apparatus was furnished by the Mead-Morrison Manufacturing Co., Boston, and was designed for a capacity of 120 tons per hour per hatch, to be delivered over either side of the ship, using one-ton clam shell buckets.

At each hatch is arranged an independent coaling outfit comprising one wire rope transmission engine for the hoisting and lowering of the coal buckets on a trolley hoist, and one engine to operate the hoist outboard





MIDSHIP SECTION FLEET COLLIER CYCLOPS.

Class.

American Bureau of Shipping A-1-17 years. One deck vessel. Ocean service rules 1908. First numeral 143.33, second numeral 74531, $\frac{L}{D} = 12.72$. Frame spacing, 30 in.

Framing.

Frames and reverse frames 1 to 18. From keel to forecastle deck: 9 x 3¾ x 3¾ in. x 28.6 lbs. channels; reverse frame (at top of floor) 3½ x 3½ in. x 8.5 lbs.

18 to 38, from keel to lower deck: 12 x 3¾ x 3¾ in. x 35 lbs. channel, split at the bilge; from lower deck to forecastle deck: 9 x 3¾ x 3¾ in. x 28.6 lbs. channel.

38 to 136, in inner bottom: frames 7 x 3½ in. x 17 lbs. angle; reverse frames, from 38 to 52, 3½ x 3½ in. x 9 lbs. angle, and from 53 to 136, 3½ x 3½ in. x 10 lbs. angle; from inner bottom to top side tank: 12 x 3¾ x 3¾ in. x 35 lbs. channel; in top side tank: 9 x 3¾ x 3¾ in. x 28.6 lbs. channel.

136 to 183, in inner bottom: frames from 136 to 165, 7 x 3½ in. x 17 lbs. angle; from 166 to 183, 7 x 3½ in. x 15 lbs. angle. Reverse frames, from 136 to 155, 3½ x 3½ in. x 10 lbs. angle, and from 156 to 183, 3½ x 3½ in. x 9 lbs. angle, doubled under boiler bearers and under engine. Inner bottom to upper deck: 12 x 3¾ in. x 35 lbs. channels. Between upper and poop deck: On alternate frames from 138 to 165, 7 x 3½ in. x 17 lbs. angles, and from 166 to 183, 7 x 3½ in. x 15 lbs. angles, bracketed to the upper deck. Every fifth to be fitted with a 15 lbs. x 24-in. belt, stiffened on inner edge by single 3 x 3 in. x 7.2 lbs. angle.

183 to 193: from keel to upper deck; 12 x 3¾ in. x 35 lbs. channel, reverse frame (at top of floor) 3½ x 3½ in. x 8.5 lbs. Between upper and poop deck: On alternate frames, 7 x 3½ in. x 15 lbs. angle, bracketed to upper deck; every fifth to be fitted with a 15-lbs. x 24-in. belt stiffened on inner edge with single 3 x 3 in. x 7.2 lbs. angle.

193 to 207: from keel to poop deck; frames 7 x 3½ in. x 15 lbs., alternate of which stops at upper deck. Reverse frames; from keel to upper deck, 7 x 3½ in. x 15 lbs. angle; forming a 9-in. deep frame.

Cant frames: 7 x 3½ in. x 15 lbs. angle.

Web frames: in engine and boiler rooms; two each side in each compartment, 24 in. deep, made up of 20 lbs. plate, 12 x 3¾ in. x 35 lbs. channel frame and double 3½ x 3½ in. x 9.8 lbs. angles. Special constructed web frames fitted in forward and after peak tanks and in oil cargo compartment.

Floors: Solid on every frame; from stem to 37, 38 in. x 16 lbs.; 38 to 50, 48 in. x 16 lbs.; 51 to 155, 48 in. x 17½ lbs., except those under boiler bearers, which are 22 lbs ; 156 to 162, 48 in. x 16 lbs.; 164 to 175, 81 in. x 22 lbs.; 176 to 179, 81 in. x 17½ lbs.; 180 to 182, 81 in. x 16 lbs.; 184 to stern, 48 in. x 16 lbs.; thickness of floors in way of stern tube, hull connection casting and strut increased to 17½ and 20 lbs. W. T. floors same thickness as ordinary floors; bounding angles, double 3½ x 3½ in. x 11.1 lbs. to shell, 3½ x 3½ in. x 9.8 lbs. to inner bottom.

Deck Beams.

Upper deck: channels fitted on every frame; from stem to 33, 10 x 3⅜ in. x 21.8 lbs.; 34 to 192, 10 x 3½ in. x 27.2 lbs., except spur beams which are 21.8 lbs. 194 to stern, 10 x 3⅜ in. x 21.8 lbs.

Berth deck: channels fitted on alternate frames; from stem to 37, 10 x 4 in. x 35 lbs.; 137 to 178, 12 x 4 in. x 44 lbs.; spur-beams, 10 x 4 in. x 35 lbs.; 180 to stern, 10 x 4 in. x 35 lbs.

Lower deck: channels; from stem to 18, 10 x 4 in. x 35 lbs. on alternate frames; from 18 to 38, 10 x 3⅜ in. x 21.8 lbs. on every frame, cut and bracketed to center line bulkhead; from 179 to stern, 10 x 4 in. x 35 lbs. on alternate frames.

Forecastle deck: channels fitted on alternate frames; from stem to 24, 10 x 3⅜ in. x 21.8 lbs.; from 25 to 33, 10 x 3½ in. x 27.2 lbs.

Poop deck: channels fitted on alternate frames; from 140 to 200. 10 x 3½ in. x 27.2 lbs.; from 201 to stern, 10 x 3⅜ in. x 21.8 lbs.; spurbeams, 10 x 3⅜ in. x 21.8 lbs.

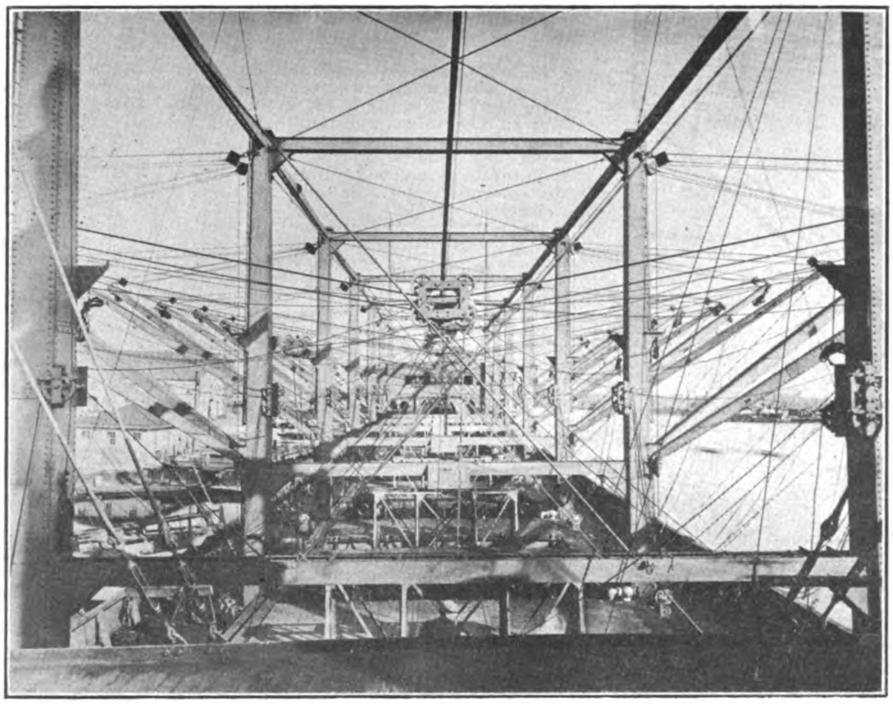
and inboard; each engine being under the control of an individual operator, although one set of engines has been arranged for experimental purposes under the combined control of one operator. This part of the outfit consists of twelve hoisting engines and twelve trolleys. On the first actual trial of this gear without previous running under load to stretch ropes and adjust machinery, delivery was made at the rate of 138 tons per hour.

The operating rigging for each of the twelve outfits consists of a heavy wire cable spanning the vessel directly over each cross hatch and suspended in position by the two steel booms referred to, one extending from each side of the vessel. On this wire span is fitted a two-wheel trolley which carries the bucket, the trolley being pulled back and forth on the span by leads to the independent trolley engine, which action is entirely independent from the hoisting and lowering of the bucket.

The operation of the bucket, which is of the clam-shell type, consists of two lines of wire rope, one to take the weight of the bucket and the other to open and shut the bucket. After closing or opening the bucket these two ropes act in unison. One end of each of the above ropes is secured to the outboard end of one of the steel booms at the end of the wire span, then they pass over two of the four leading sheaves provided in the handling part of the trolley, and pass down through block and sheaves at the head gear of the bucket and up again through the remaining two leading sheaves in the trolley, thence outboard to two leading sheaves in a block at the head of the opposite boom, from whence they lead through deck leads to two independent drums on the large hoisting engine.

These drums are under independent control, being operated by friction control levers controlled by the one man operating the engine, which runs continuously in one direction, the lowering of the bucket being controlled by friction band and rope drums. Thus, one man controls the vertical action of the bucket and the other operator the horizontal action, both being located so that they face the hatch and bucket and can observe the action necessary throughout the total travel of the bucket.

Trimming coal fore and aft from one compartment to another or to the after end of vessel from any of the main holds is arranged for by the provision of a fore and aft I-beam trolley rail at the centerline of the ship, permanently suspended from the upper steel tie supporting the heads of the coaling boom masts, as seen in the illustrations; on this rail is carried an appropriate trolley with suitable leading sheaves for the operation of the transmission ropes and one of the coaling buckets in a manner similar to the cross coaling gear, using the aftermost set of engines, which is provided with an extra large set of rope drums to accommodate the necessarily longer transmission ropes of the fore and aft gear.

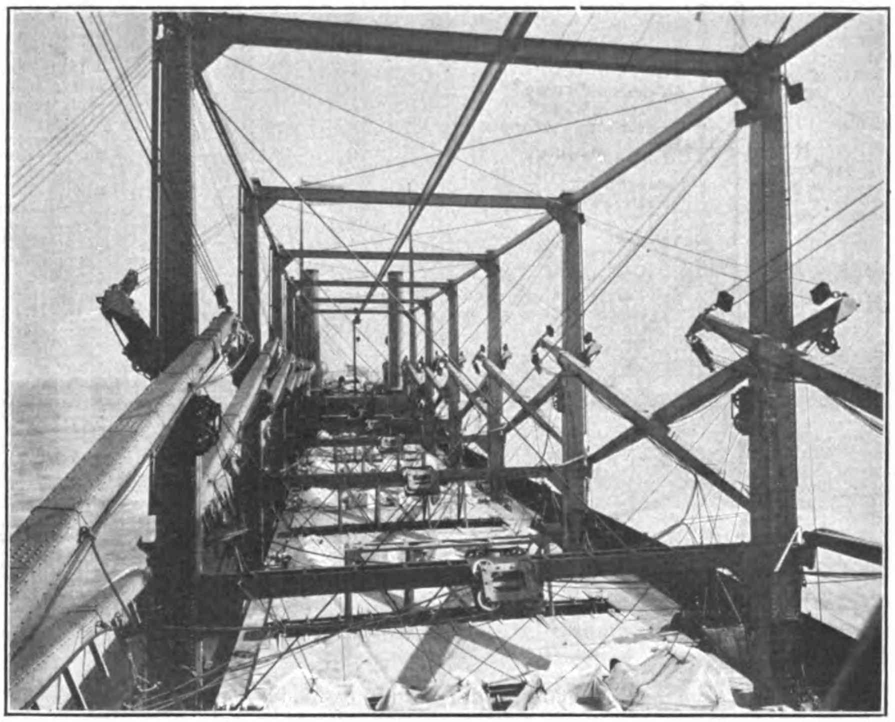


COLLIER CYCLOPS, LOOKING FORWARD, COALING GEAR RIGGED.

Coal can be taken from any of the compartments, except the combined oil and coal compartments forward, and placed in the ship's bunkers or landed aft on deck in a position suitable for handling in coaling ship at sea.

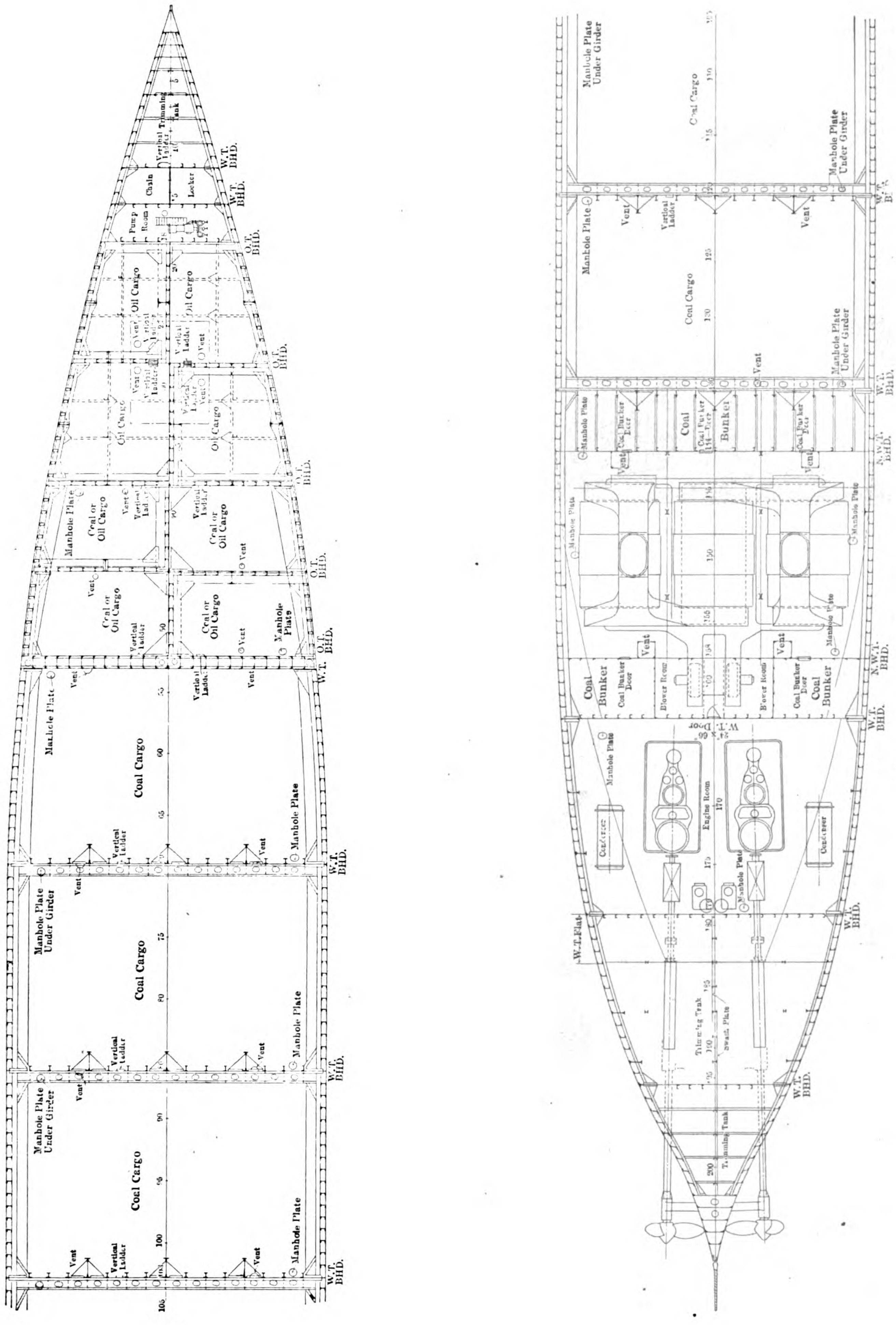
On test the rig has handled as high as 200 tons per hour or at the rate of 2,400 tons per hour for the ship.

The propelling machinery consists of two sets of three-cylinder, triple expansion, surface condensing engines, with cylinders 27½ x 46 x 76 in. diameter, and 48 in. stroke. There are three double-ended boilers, 16 ft. 3 in. mean diameter, 22 ft. 3 in. long, with eight 40-in. corrugated removable furnaces in each. They are fitted with a heated-air forced draft system, supplied by two fans. There is an upright donkey boiler 7 ft. 2 in. diameter, by 12 ft. 5 in. high. In each fire room is installed a new design of hydraulic ash expeller for discharging ashes through the ship's bottom.



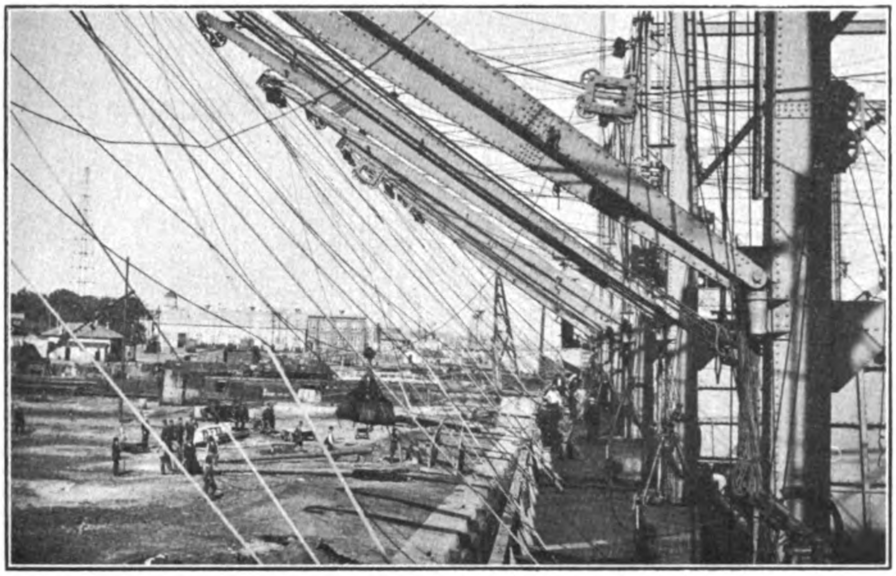
COLLIER CYCLOPS, LOOKING AFT, COALING GEAR STOWED.

This machinery was designed for a



HOLD PLAN FLEET COLLIER CYCLOPS.

speed of 14 knots, and to make about 7,200 collective indicated horsepower, with a working steam pressure of 190 lb., above the atmosphere, at 94 revolutions per minute. On the forty-eight hour official sea trial, which began Oct. 26, 1910, the speed averaged 14.46 knots, the indicated horsepower developed was 6,705, with a steam pressure of 190 lb. and revolutions per minute averaging 91.3. During this trial the coal consumption per indicated horsepower per hour was only 1.48 lb. This, it must be conceded, is remarkably good when it is considered that this figure represents the total coal consumption referred to main engine horsepower. In addition to the steam used by the main engines, all auxiliaries, including refrigerating machinery, evaporating and distilling plant, and dynamos for electric lighting, were in operation.



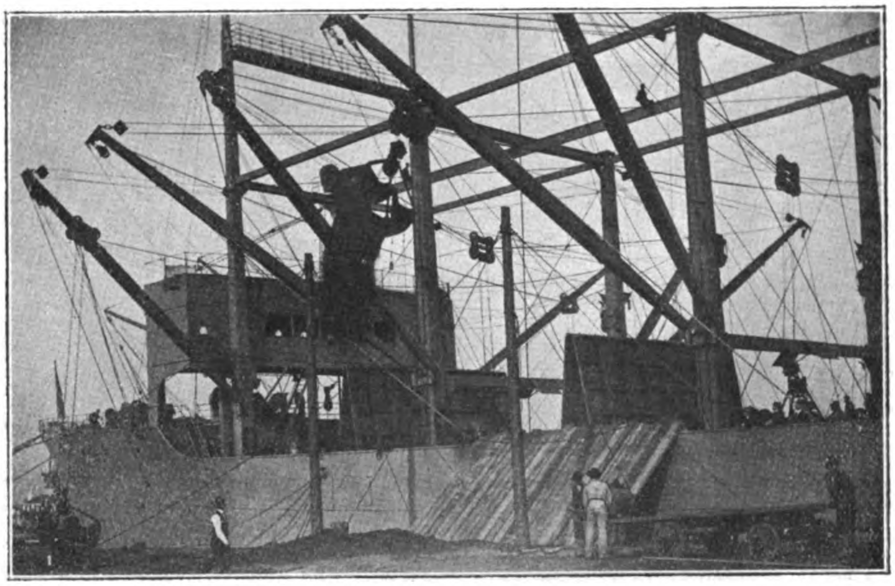
COLLIER CYCLOPS, HANDLING BAGGED COAL.

On the five high speed standardizing runs over the measured mile course at Delaware breakwater, the vessel averaged 15.49 knots on an average indicated horsepower of 8,060 at 97.97 revolutions.

The quarters are located aft in the poop deck house and ample accommodations are provided for the commanding officer, watch officers, warrant officers, firemen and crew. These quarters are provided with all the latest conveniences in the way of light, ventilation and sanitary appliances. The officers' accommodations are provided with dining and mess rooms, pantries, galley, bath room, staterooms, shower baths, etc. The vessel is lighted throughout by electric lights.

Emergency quarters are also provided for the captain on the bridge deck, as it is expected that the commanding officer can occupy these for a considerable time when necessary.

The Cyclops is the largest vessel of the single deck type yet constructed on the Atlantic coast and exceptional care has been taken in her design and construction to insure strength and seaworthiness. That she has given a most excellent account of herself both in steaming qualities and in handling cargo is amply demonstrated by the figures quoted herewith.



COLLIER CYCLOPS, DISCHARGING COAL OVER SIDE.

The Tietjen & Lang Dry Dock Co., Hoboken, N. J., has issued a very attractive calendar for 1911, including tides from Maine to Florida.

Changes in Lloyds Governing Body

An important change in the constitution of the governing body of Lloyds Register of Shipping has just been decided upon. The decision in question, which has not yet been carried into effect, is to give direct representation to ship builders and engineers.

The society, which was established on its present basis in 1834, has up to the present been under the control of a committee composed of shipowners, underwriters and merchants elected by public bodies in London and the other great shipping ports of the United Kingdom. In those earliest days of the survey and classification of shipping, it was thought with some reason that a committee so composed was fully representative of all the interests concerned. The rapid growth of great ship building yards and engineering works, forming as they have done what are practically universities of naval architecture and marine engineering, introduced, however, a new factor in the world of shipping, and the committee felt that the usefulness of the society would be greatly enhanced if the scientific knowledge and practical experience which had contributed so largely to the building up of those enterprises could be enlisted in its service. Accordingly, in 1890, a consultative committee was formed, elected by the principal British technical institutions, of gentlemen whose ability and attainments entitle them to be ranked among the foremost authorities

on everything pertaining to the technical side of the society's work.

Mr. Devitt, the chairman of Lloyd's Register, in his speech at a recent meeting, referred to the valuable work which the technical committee, thus brought into existence, had done for the society. Since its formation, it had considered and reported upon every proposal for the various amendments which had been made in the society's rules, and not one of these alterations had been carried into effect without first receiving its approval. He wished to express on behalf of the general committee their appreciation of the high value of the services rendered in this way by the members of the technical committee, particularly in the consideration of the society's new rules, which were published in July, 1909, and embodied the results of the most advanced theory and practice in ship building and marine engineering. The general approval accorded to these rules was sufficiently evidenced by the fact that since their introduction the plans of over a thousand vessels, amounting to 2,225,000 tons of shipping, had been submitted and passed with a view to the classification of the vessels in Lloyds Register. The committee had recently given their earnest consideration to the question of a more direct representation of the ship building and engineering interests, and he was pleased to say that a definite conclusion on the subject would be shortly arrived at.

The decision thus foreshadowed by Mr. Devitt was come to at a meeting of the committee, Dec. 15, last.

New Sand Barge for Lake Michigan

THE sand barge M. G. Hausler is the latest addition to the fleet of boats owned and operated by the Lake Sand Co., of Chicago. This vessel, designed and built by the Manitowoc Ship Building & Dry Dock Co., Manitowoc, Wis., was delivered to the owners, Nov. 24, and is the second steel sand barge built by this company for the Lake Sand Co. The new vessel is 164 ft. long over all, 35 ft. beam and 10 ft. deep, and has a carrying capacity of 600 to 650 cu. yds. of sand in the hopper on deck. The hopper is 90 ft. long and 6 ft. deep, divided into six compartments,—to obviate the shifting of the cargo. The hopper is built as a part of the hull, the regular side frames extending to the top of the walls and plated in the same way as the main hull.

There are five watertight athwartship bulkheads in the hull and a fore and aft bulkhead extending from the collision bulkhead aft to the boiler room. The hull is, therefore, divided into nine watertight compartments, supplemented by a small watertight flat around the stern tube, each compartment having a separate bilge pipe, so that water ballast may be carried in any or all the compartments.

The after deck house is carried out flush with the sides and end of the boat, built of steel throughout, and forms an integral part of the hull. The main deck throughout this space is raised 18 in. above that of the hopper space. This deck house contains the boiler room, engine room, pump room and living quarters.

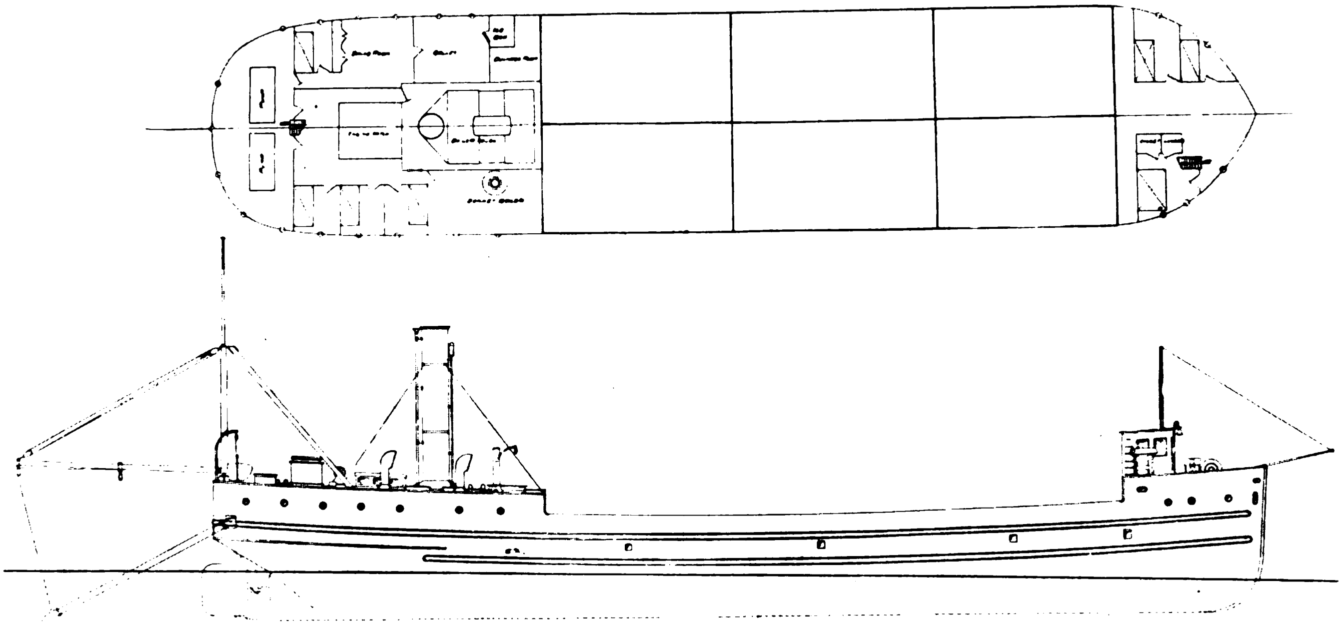
There are four large, comfortable crew rooms in this space besides the galley and dining room, all finished in southern pine and varnished.

At one side of the boiler enclosure is a room for the donkey boiler, electric plant and work bench; on the other side is a dunnage room.

Following the usual practice of the Lake Sand Co., the two 12-in. sand pumps are located on the fan tail, and above these are the derricks for handling the suction hose. These derricks are operated by a deck winch on the spar deck.

The deck over the after house is kept clear of obstructions, except for the necessary skylight and hatches, and is used for the stowing of the sluice boxes and other pumping gear.

The forecastle head on the main deck contains a large room for the captain, with toilet and locker. There are also two rooms for deck hands and crew.



PROFILE AND DECK PLAN OF SAND SUCKER.

On the forward spar deck is placed the pilot house, which contains a Dake steam steerer. A steam windlass forward handles two stockless anchors.

The propelling machinery consists of a 16-34 x 26 fore and aft compound engine with jet condenser. The engine swings an 8-ft. wheel and develops 400 H. P. A bilge pump with an 8-in. suction is connected to the bilge piping and sea cocks.

The boiler is a Scotch marine type with a steam drum, and is 11 ft. 6 in. diameter and 13 ft. long, carrying 150 lb. of steam. The boiler contains three 36-in. Morrison furnaces and 216 3½-in. tubes and has a grate surface of 50 sq. ft. and heating surface of 2,310 sq. ft.

The Hausler, with a full load, makes a speed of 10½ miles per hour, and her regular runs are between Chicago and Michigan City, Ind., and St. Joseph, Mich.

This is one of the most modern vessels of her type on the lakes and, owing to the completeness with which she may be closed up, forward and aft, is quite seaworthy. By means of freeing ports in each pocket, the vessel may be lightered of her load, in case of necessity, in the short space of five minutes.

Dangers of Alaskan Navigation

THE dire need of more aids to navigation in the Alaskan seas is being agitated more and more strongly by the many companies which have entered into that trade during the past decade. Since shipping began to be a factor to the far north the toll of the rough coast has been more than 50 vessels, the major portion of which were steamers of considerable length and beam. The last big vessel to find the unchartered rocks was the steamer Olympia, which went ashore on Dec. 10 in Bligh island, Prince William Sound, and which, owing to the lateness of the season and her exposed conditions, will probably be a total loss.

The ragged coast of the great north country is strewn with the wrecks of ships and beneath the blue waters of the inside passage lie many bodies and much valuable gold dust which went down in recent years. The topography of Canada and Alaska makes it practically impossible for the railroads to be pushed up along the coast and most of the communication between the various points on Alaska's shores must be by water. The wonderful wealth and latent resources of the country, with its immense career of the past years and its wonderful future when the coal, copper, gold and other minerals are properly exploited and developed means that steamships must ply to those shores hereafter in greater numbers.

In recent wrecks there have been few lives lost, which is considered a great piece of fortune by the owners of the vessels. The Olympia's passengers escaped unharmed and there are very few deaths recorded as the result of the grounding of the Portland, Yucatan, Ohio and Saratoga, although in a majority of instances the steamers were total losses. The loss of life, however, was heavy on other vessels, which include the Clara Nevada, lost in Lynn canal; the Discovery, which went to sea and has never been heard from since; the Star of Bengal, which exacted 110 lives on Coronation island, the Islander, the Laurada and the Albion.

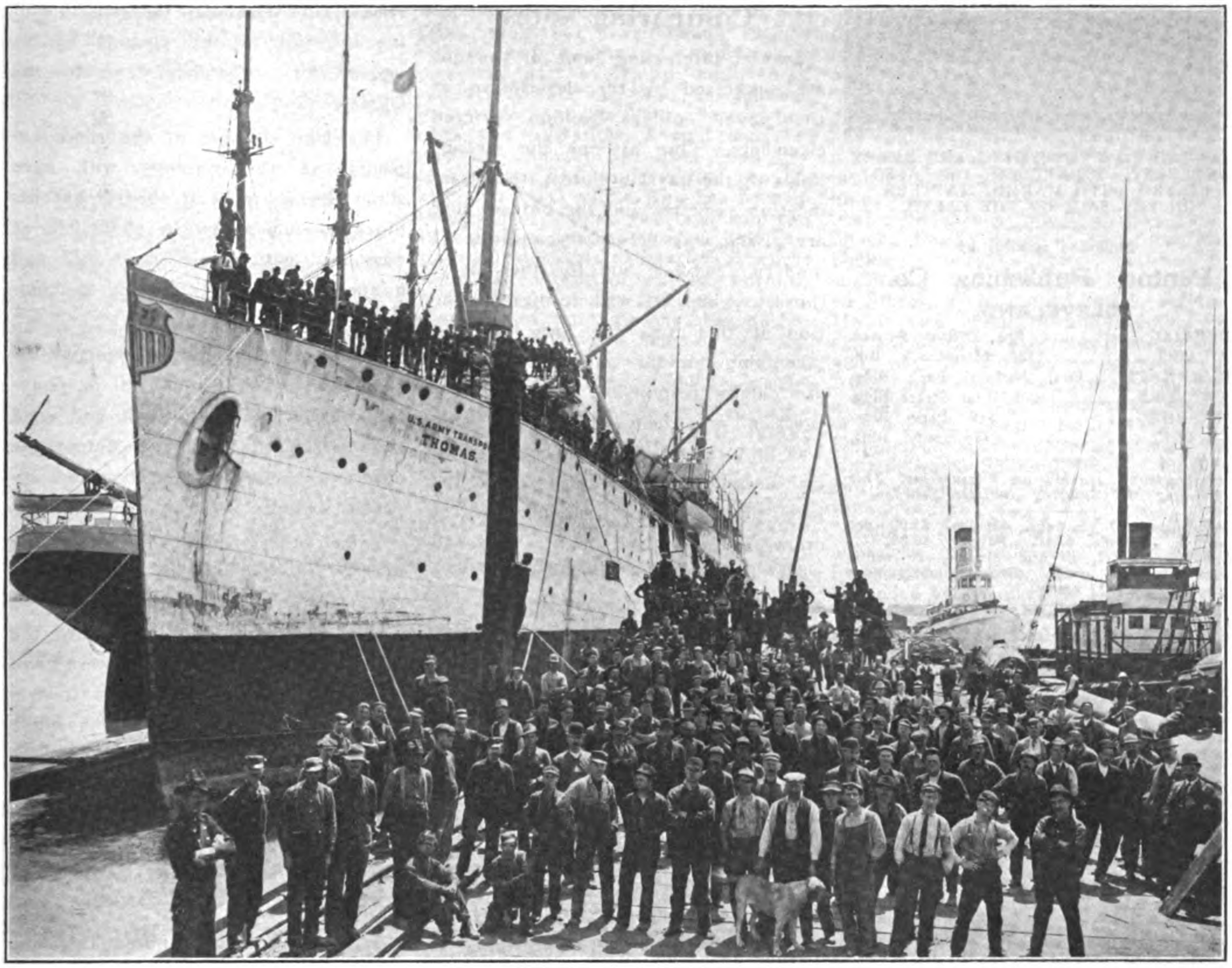
The loss of life is one item in the wrecking of the vessels, but the underwriters have paid heavy for the sinking and battering to pieces of many hulls, with their machinery and fittings. The cargoes have always been large ones and even when cannery barks went down which were carrying the Northern pack to the States their cargoes ran into thousands of dollars each. Such a cargo is practically sure to be spoiled as soon as the vessel springs the first leak, for as soon as the water reaches the fish they are spoiled and unfit for sale.

Gov. Walter E. Clark, of Alaska, has taken up the subject in a vigorous manner and is trying to get the bureaus at Washington to take some notice of the lands which the country owns in the far Northwest. The recent visit of Secretary Nagel of the department of commerce and labor to the shores brought its fruit in recommendations amounting to about $350,000. The aids which he indorsed had had the previous endorsement of the Alaska Steamship Co., Alaska Pacific Steamship Co., Alaska Coast Steamship Co., Pacific Coast Steamship Co., Humboldt Steamship Co., Northland Steamship Co. and many other smaller lines carrying on business to the new country.

The steamer Olympia was sent out by the Alaska Steamship Co. to take the place of the steamer Northwestern, which had run ashore during a dense fog on the rocks at False Bay on the West coast of San Juan Island while bound from Seattle to Cordova. She went onto the rocks during a furious windstorm, on the same day that the Northwestern was finally salved from her perilous position. The 106 passengers were taken off in safety after much hardship. The steamer is valued at $210,000 and was insured for $155,000 at Lloyds. The loss of the Olympia coming so close upon the heels of the Northwestern and the total loss of the Portland, owned by the Alaska Coast Co., in November, has served to make those advocating more lights and aids in the North redouble their energies.

One of the mysteries of the North Pacific coast is the finding of wreckage of the steamer St. Denis coming ashore at various points from the rock bound coast of Vancouver island to the shores of Southern Washington. It is believed conclusively that she has been a total loss and it is assumed that she struck hard weather off the mouth of the Columbia and was driven north and ashore on the Vancouver island coast, where she was beaten to pieces. Nothing has been heard of her crew of 21 and the two passengers which she had on board. The St. Denis had been employed under charter to the T. Boscowitz Steamship Co. in the Victoria-Vancouver-Prince Rupert trade and when this charter expired was taken for the Central American trade and sailed from Victoria to enter that service with 550 tons of coal and lumber cargo on Nov. 21. The first note of wreckage bearing her name was made on Dec. 10 at Cape Scott, which included oars, hatches and a large portion of her pilot house. The steamer Tees, in the Canadian Pacific Steamship Co.'s service, a few days later reported by wireless that it had picked up one of the lost steamer's boats and the fact that a large quantity of mixed lumber cargo was afloat between Hesquoit and Estevan.

On Dec. 14 the steamer Kitsap, which carries passengers from Seattle to Paulsbo on Puget Sound, ran down and sunk the launch Columbia during a dense fog on Elliot Bay and a few minutes later was rammed and sent into 200 ft. of water by the steamer Indianapolis from Tacoma to Seattle. The Indianapolis sent her steel bow



ARMY TRANSPORT THOMAS AT THE MOORE & SCOTT IRON WORKS, SAN FRANCISCO.

into the wooden boat to the deck house and held her there until the 30 passengers had been taken off. An attempt to carry her to the beach in that manner proved ineffective and the little steamer sank. The damage to the Indianapolis was slight. The Kitsap was valued at $50,000 and an effort is being made to salve her by the pontoon system. There are some doubts expressed as to the outcome of the attempt because of the depth to which she was sent. The two collisions occurred within a few hundred feet of the dock at which the two steamers land their passengers.

Obituary

Walter L. Pierce, who for 32 years has been connected with the Lidgerwood Manufacturing Co., and for 29 years its secretary and general manager, died suddenly of heart failure at his winter home in the Hotel St. Andrews, New York City, Dec. 10. He was born at Dorchester, Mass., on June 8, 1855.

He was known to a wide circle of personal and business associates. He was remarkable as an organizer and so perfect was his work that no detail of the great business which grew up under his hand was neglected during his long absences from his desk while seeking health and the coherent body which he formed is a monument to the efficiency of his work. Besides his connection with the Lidgerwood Mfg. Co. he was treasurer of the Hayward Co. and of the Gorton-Lidgerwood Co. His summer home was at Englewood, N. J., where he was a member of the Englewood Country club. He was also a member of the Apawamis Golf club, the Wright Fish and Game club of Canada, the Lawyers' club, the Engineers' club, the Machinery club, in which he was also a director, an associate member of the Naval Architects and Marine Engineers and of the American Society of Mechanical Engineers and a past president of the National Metal Trades Association.

At the instance of Representative Davidson, of Oshkosh, Wis., an amendment has been inserted in the rivers and harbors bill for a survey of the harbor and rivers at Manitowoc, Wis., by the construction of turning basins and also with a view to the creation of a harbor of refuge. In the last few years Manitowoc has expended about $85,000 for the maintenance of its inner harbor. The purpose of the proposed survey is to relieve the city of this expense, as its benefits are largely shared by through commerce.

The steamers Harvard and Yale, formerly owned by the Metropolitan Steamship Co., have safely reached the Pacific coast and will operate in the San Francisco-San Pedro service of the Pacific Navigation Co. hereafter.

The Schuette Recording Compass Co., Manitowoc, Wis., have just issued an attractive little calendar, the pictorial part of which is a beautiful drawing of their recording compass.

THE MARINE REVIEW

DEVOTED TO EVERYTHING AND EVERY INTEREST CONNECTED OR ASSOCIATED WITH MARINE MATTERS ON THE FACE OF THE EARTH.

Published monthly by

Penton Publishing Co.

CLEVELAND.

BUFFALO..............932 Ellicott Square.
CHICAGO............1328 Monadnock Blk.
CINCINNATI.....First National Bank Bldg.
NEW YORK..........1005 West Street Bldg.
PITTSBURG................510 Park Bldg.
SEATTLE..................942 Henry Bldg.

Correspondence on Marine Engineering, Ship Building and Shipping Subjects Solicited.

Subscription, U. S. and Mexico, $1.00 per annum. Canada, $1.50. Foreign, $2.00. Single copies, U. S. and Mexico, 10 cents. Elsewhere, 15 cents. Back numbers over three months, 25 cents.

Change of advertising copy must reach this office on or before the first of each month.

The Cleveland News Co. will supply the trade with the MARINE REVIEW through the regular channels of the American News Co.

European Agents, The International News Company, Breams Building, Chancery Lane, London, E. C., England.

Entered at the Post Office at Cleveland, Ohio, as Second Class Matter.

January, 1911

Comparing Notes

Several interesting lines of thought are suggested by the description of the naval collier Cyclops, printed elsewhere. One by one the strongholds of the naval architect, the classification societies and the old sea dog are giving way before the assaults of modern progress, and for the fall of those to which we wish to direct attention at this time the long despised lake ship builder and his methods are chiefly responsible. For generations it was believed that no ship was fit to go to sea with her machinery elsewhere than amidships and the lake practice was denounced as a crazy scheme that might work all right on fresh water, but which no seaman, nor any builder or designer who knew his business would ever propose for sea-going work.

Coast ports, however, long since ceased to look with curiosity on the sea-going cargo ship with her machinery aft; the advantages of the type, practical and commercial, were too obvious to be ignored. The vastly better working and greater comfort in heavy weather, too, soon converted those who had opportunity of proving them and it is doubtful if any master who has tried both types would ever want to go back to the older.

So with the wide hatches, the channel system of construction, the single deck type even in large sizes, the elimination of wood ceiling in cargo holds, the improvement in quarters, and sundry other minor features.

But there yet remained one fortress which resisted all assaults: The pilot house and bridge. "Why," said the sea-going master, and all hands accepted his dictum, "it wouldn't stand ten minutes, up the eyes of her, in a head sea." And this even with a bottle nosed tramp that couldn't make eight knots. And now comes the Cyclops and demolishes the last remaining feature which distinguished the sea-going ship from her sisters of the great lakes. And not a slow ship either, as cargo ships go; 14½ knots, to the average cargo ship master, is merely a figure of speech, and has much the same meaning to him as the altitude figures quoted for aeroplanes have to the layman.

The lake steamer of the same capacity as the Cyclops will have about 2½ ft. more freeboard, but her block co-efficient will be about 0.90 as compared with the Cyclops 0.72 and a speed of about 10 knots as compared with 14.5.

However, we hazard nothing in asserting that the fashion will be popular and that before long it will need the eye of the sailor to detect the difference between the lake and the ocean steamer.

Some other technically interesting points are also worth noting. The opportunity to compare results from a ship of the Cyclops type with the ordinary formulae for powers and speeds of cargo ships is not so frequent as to be common and is worth improving. Bearing in mind that the horsepower for 14 knots speed was calculated at 7,200 it will be noted first that practically half a knot better was obtained with nearly 500 H. P. less.

It will be further noted that the power for 14.46 and 15.49 knots respectively follows very closely, almost exactly in fact, the rule of cubes of speeds, and if the rule is worked back to 14 knots it will be found that the power required for that speed would be about 6,120 horsepower.

For rough and ready calculations on powers and speeds of cargo ships probably the Mumford formula is most generally used. In this the expression $(L \times D \times 1.7) + (L \times B \times C)$, in which L = length perpendiculars; D = mean draught; B = beam, all in feet, and C = block co-efficient, gives the wetted surface in square feet. Substituting the figures given for the Cyclops it will be found that the wetted surface is about 48,600 sq. ft. If 4½ horsepower will drive 100 sq. ft. of fairly clean surface at 10 knots, 2,190 horsepower will be required for the ship for 10 knots speed, and if the powers are as the cubes of speed 6,010 horsepower will be required for 14 knots

which compares very closely indeed with the figures actually obtained, but appear to be considerably at variance with the characteristics prescribed by the department.

Reporting Progress

It is with no small degree of satisfaction that THE MARINE REVIEW contemplates the plan of congress to appoint a commission to investigate the administration of the navy. The time is certainly opportune. If the proper sort of a commission is appointed, not one dominated by the defendant department, and steps taken to protect those who can and will testify under assurance of protection from a hostile secretary of the navy and those whom he seeks to shield, the country will learn some things regarding its spectacular plaything which will cause it to sit up.

Since THE MARINE REVIEW has, more than once, by implication at least, indicated a knowledge of good commission material, it has addressed the following letter to each member of the committee on Naval Affairs and by its publication evidences its desire to substantiate earlier statements.

Dec. 31, 1910.

It is reported on apparently good authority that the Naval Committee will ask the appointment of a commission to investigate the subject of naval re-organization. For three years THE MARINE REVIEW has steadily advocated this course, and has produced and published volumes, almost, of evidence of its necessity and has volumes more available.

Not only that, but our files contain many letters from naval officers commending our attitude and verifying our charges. If such a commission is appointed, THE MARINE REVIEW, while of course declining to divulge these letters or their authors, will gladly suggest profitable sources of information provided those called are assured of protection.

THE MARINE REVIEW takes it for granted that the members of such a commission should be free from any suspicion of interest in naval contracts or supplies, and while the field, so far as men capable of passing on questions of shipbuilding and shipyard administration in particular and who are not associated with any shipbuilding firm or company are concerned, is relatively small, there are, fortunately, not wanting men of the highest standing and character whose knowledge and judgment are of the very highest value.

We venture to suggest that the commission should include besides three such, one or two men who have been prominently successful in modern scientific industrial development, including the cost accounting, which is a necessary part of it; an engineer of national reputation who is familiar with modern power plant construction, costs and operation; a civil engineer who is competent to pass upon dry dock design and construction, etc.; at least one naval officer who has been in command of a navy yard and who can inform the commission as to the customs and methods of navy yard work; one naval constructor who has been, or is, in charge of construction work in a navy yard, and one engineer officer. THE MARINE REVIEW suggests the following gentlemen as eminently suitable and who would do honor to the position:

Shipbuilding and shipyard management—W. I. Babcock, New York; George W. Dickie, San Francisco; Robert Moran, Rosario, Wash.

Industrial experts (select two)—J. M. Dodge, Philadelphia; Harrington Emerson, New York; F. W. Taylor, Philadelphia; Wilfred Lewis, Philadelphia.

Power plant engineering (select one)—Frederick Sargent, Chicago; Bion J. Arnold, Chicago.

Civil engineers (select one)—Alfred Noble, New York; A. V. Powell, Chicago.

Naval officers—Caspar F. Goodrich, Rear Admiral, U. S. N., retired; W. J. Baxter, Naval Constructor, New York Navy Yard; J. K. Robison, Lieut. Commander, U. S. N.

We append a brief sketch of the civilians in the foregoing list.

W. I. Babcock stands in the front rank of American ship builders. Graduated from Rensselaer Polytechnic Institute in 1878; spent the next seven years in practical ship building in the Roach yard at Chester, Pa., then probably the leading shipyard of the United States; assistant superintendent Providence & Stonington Steamship Co., 1885-7; manager of the Union Dry Dock Co., Buffalo, 1887-9. In 1889 he became manager of the newly-organized Chicago Shipbuilding Co., and afterwards its president. The history of this concern was one of remarkable success and its management and methods attracted wide attention. The first practical application of pneumatic tools to shipwork were worked out here, and many of the tools which are standard were designed by Mr. Babcock and his staff. The mold system of ship construction, now universal in lake yards and largely employed elsewhere, was worked out by him and shipbuilders from far and wide visited the yard to examine into its workings. Since 1900 he has confined himself to private practice with offices in New York and Cleveland. Member of the council of Society of Naval Architects and Marine Engineers; member of the Institute of Naval Architects of Great Britain, and of the American Society of Naval Engineers. As an organizer and as a master of commercial shipbuilding he has no superior.

George W. Dickie is another well-known successful designer and shipyard executive, having been for many years vice president and manager of the Union Iron Works, San Francisco, and as such responsible for some of the best ships of the new navy, including the famous Oregon, and many fine merchant ships. The Union Iron Works was also a builder of a line of engineering products such as pumping and mining machinery, and Mr. Dickie's engineering activities brought him into intimate contact with many large industrial undertakings. Of industrial conditions as affecting navy yards on the Pacific coast in particular Mr. Dickie is perhaps better qualified to speak than any other man in the United States, in or out of public service. He is vice president and member of Council of Society of Naval Architects and Marine Engineers, member of American Society of Mechanical Engineers and of the Engineering Society of the Pacific coast. Retired from the Union Iron Works upon its sale to the United States Shipbuilding Co. in 1904 and has since confined himself to private practice.

Robert Moran arrived at Seattle, penniless, from his New Jersey home in 1880, being then 22 years old. He started a small machine shop, 20 x 30 ft., with three brothers. It developed rapidly and in 1888 he organized the Seattle Dry Dock & Ship Building Co. He was elected mayor of Seattle in 1889. During that year Seattle was practically destroyed by fire, including his shipyard. He rebuilt it bigger than ever in 1890 and organized the Moran Bros. Co. In 1892 secured the contract for pumping plant at Bremerton Navy Yard. He built the torpedo boat Rowan and battleship Nebraska, and when gold was discovered in the Yukon in 1897 he was very helpful in building steamers to accommodate the sudden rush to the gold fields. He sold his interest in the ship yard in 1905. He is in every sense of the word a self-made man.

J. M. Dodge, manager Link Belt Engineering Co., Philadelphia, one of the foremost experts in scientific industrial management in the United States.

Harrington Emerson, New York, well known for his success in increasing efficiency of industrial plants, among which his remarkable work on the Santa Fe railroad system has been notable.

F. W. Taylor, Philadelphia, formerly works engineer to Bethlehem Steel Co.; one of the pioneers in scientific shop management and one of the inventors of the so-called Taylor-White process of treating tool steel, which has totally revolutionized tool steel making and machine tool building. He is well known as the author of "The Art of Cutting Metals." Out of his work at Bethlehem has come most of what is known as modern scientific management. Past president, American Society of Mechanical Engineers.

Wilfred Lewis, Philadelphia, engineer Tabor Manufacturing Co. A well known figure in engineering circles and among large industrial concerns. Has been prominently identified with the movement for improved efficiency in shop management whereby greatly increased output, together with reduced costs and increased pay for the workmen are secured.

Frederick Sargent and B. J. Arnold are both too well known as consulting

engineers, mechanical and electrical, to need more than mention. The former was born in England 1859; graduate of Anderson University, Glasgow. Came to United States in 1883, has been consulting engineer in the city of Chicago since 1890; manager of mechanical and electrical department of Chicago Exposition in 1893, and was awarded artist's model; senior member of the firm of Sargent & Lundy, Railway Exchange building, Chicago. He is a member of the American Society of Mechanical Engineers and of the Western Society of Engineers and the Technical Society.

The latter has been prominent in many of the largest electrical engineering projects in the United States, and has recently been employed as one of the commission to re-organize the street railway systems of Chicago, a work in which he manifested ability, both constructive and executive, of the highest order.

Of Alfred Noble it is almost unnecessary to speak. Graduate of the University of Michigan; was at Sault Ste. Marie as civil engineer during the construction of the Poe lock; member of United States Board of Engineers on Deep Waterways, member Isthmian Canal Commission, consulting engineer Pennsylvania tunnel under Hudson river. He is largely responsible for the adoption of the lock type of canal at Panama. Recently awarded John Fritz medal by Franklin Institute, Philadelphia.

A. V. Powell, Chicago, graduated Renssalaer Polytechnic. Expert in dry dock construction, tunnel and water front improvement.

Admiral Caspar F. Goodrich, U. S. N., recently retired. At time of retirement in command of New York navy yard.

W. J. Baxter, constructor U. S. N. in charge of construction at New York Navy Yard.

J. K. Robison, lieutenant commander, U. S. N. An engineer officer of ability and one of those sent to Europe for post graduate course after leaving Annapolis. On duty at Bureau of Steam Engineering.

We commend this list to your careful consideration.

Respectfully yours,
THE MARINE REVIEW.

Military Ideals

The seismograph in THE MARINE REVIEW office has for several weeks given unmistakable indications of violent disturbances, present and to come, in the general direction of the New York navy yard. Sympathetic symptoms are also manifesting themselves in the valley of the Potomac. A violent eruption may be expected at any moment, and the word has been passed to all hands to stand from under.

The commandant, the engineer officer and the horde of gallant line officers who brave the perils of the deep in the course of duty at the New York navy yard are, we have information, deeply worried (not scared, of course not) for fear the committee on naval affairs will learn of the actual conditions regarding the work on the battleship Florida.

It will be remembered that as long ago as 1909 Mr. Meyer, moving heaven and earth to get authority to introduce his "reorganization" and willing to promise anything, made certain promises to the committee regarding the machinery of the Florida, to be constructed at the New York yard. "We'll show 'em," said Mr. Meyer and his monitors, and they have.

Admiral Leutze, one of the ablest line officers in the service and acknowledged the "best equipped" among them for the management of an industrial establishment, was, unfortunately for himself and his reputation, selected as commandant. The qualifications for the B. E. degree will presently appear, though in justice to Admiral Leutze it should be said that the duty and the brevet rank are not of his seeking; he is merely the victim of navy methods.

The work on the Florida was to be completed by July 1, 1911, and the department has repeatedly stated that the ship would be ready for service by that date, although it has been a common topic of conversation, for many months, among those who are familiar with the conditions, that the statement was not well founded, and that the ship would be seriously delayed, chiefly due to the inefficiency of the machinery division. The inexperienced line officers in charge of this divison were, however, in ignorance of this and knew not how to better conditions if they had known.

About Dec. 1 the engineer officer of the yard awoke to the fact that July 1 was only seven months away and the machinery not only had yet to be completed in the shops but installed in the ship. Being a little uneasy over the prospect that there might be a *slight* delay he called together the foremen to consult on expediting the work and was told that completion by July 1 was an impossibility and that even for Dec. 1 it would be necessary to contract out a large part of the work.

The engineer officer thereupon made a written report to the commandant regarding the delay, which the latter forwarded to Washington *without reading* and his first intimation that a battleship he is building is to be delayed five or six months is a letter from Washington to that effect! Language at times is inadequate and this is one of the occasions. A general manager who did not know that the most important work he had in hand would be delayed six months until advised by the department.

But wait! The general manager wants a report for himself so he writes the engineer officer and in order to dodge past the earlier report, which was loaded, says referring to it, "This letter, from its routine character passed through the office without coming to the personal notice of the commandant." This is not intended to be humorous so please don't laugh. "Routine character." Well, maybe. But the subsequent proceedings won't be much like routine. It is pertinent to ask, however, what an emergency might be. Probably for a subordinate to pass the commandant to windward.

It further appears from the commandant's letter that the rotors for the Florida's turbines have now been contracted outside therefore it is now hoped that the rest of the work will be "pushed energetically."

If these conditions obtain under the "best equipped" line officer we hope we may ask with humility what might be expected from the average.

Now all this is mildly interesting, but if you want to see the inside of naval methods take a peep at paragraph 4. "Submit recommendations for discharge or reduction of the members of the supervisory force deemed blamable for failure to keep the work on the Florida up to date."

The general manager orders his next in rank to find a scapegoat. It

is an elevating and ennobling spectacle. And he, or they, will be found, never fear. If our naval officers possess no more courage than is indicated by this order, which is presumably strictly within the regulations, then Heaven help our navy. In civil life it would be called "yellow" and its sponsor would be ostracized. It is all right in the navy, however—it is the navy way. The Meyer system holds up lofty ideals to young naval officers, they are worthy of the mind which now dominates the service and from which it is to be hoped it will recover.

There is more to this entertaining and illuminating correspondence but we refrain—for the present.

Ore on Dock Dec. 1

Figures compiled by THE MARINE REVIEW from the returns sent in by the various dock companies show that iron ore receipts at the Lake Erie ports during the season of 1910 were 34,042,897 tons, out of a total movement of ore by lake of 42,620,201 tons. Lake Erie docks on Dec. 1 held a balance of 9,426,881 tons, which is the largest store on hand in the history of the traffic, the previous high figure being in 1909, when 8,965,789 tons were on hand.

During 1909 the total shipment by lake was 41,683,873 tons, of which Lake Erie docks received 33,672,825 tons and held a balance on Dec. 1, 1909, of 8,965,789 tons. During 1908, the total shipment by lake was 25,427,094 tons, of which Lake Erie docks received 20,414,491 tons and held a balance on Dec. 1, 1908, of 8,441,533 tons. During 1907 the total shipment by lake was 41,288,755 tons, of which Lake Erie docks received 35,195,758 tons and held a balance on Dec. 1, 1907, of 7,385,728 tons. The reserve of 9,426,881 is more than will be needed for winter consumption. Never in the history of the trade have 5,000,000 tons gone forward from dock to furnace during the winter season.

Shipments to furnaces between May 1 and Dec. 1, 1910, aggregate 30,060,096 tons, compared with 30,077,304 tons in 1909, 17,453,258 tons in 1908, 29,787,018 tons in 1907, 27,615,392 tons in 1906, 24,311,720 tons in 1905, 16,658,806 tons in 1904, 16,903,013 tons in 1903, 18,423,364 tons in 1902 and with 14,204,596 tons in 1901.

The shipments to furnaces during the season of navigation, as referred to, are determined in this way: First, we have the amount of ore on the Lake Erie docks before the opening of navigation, May 1 last, 5,444,080 tons; add to this the receipts of the season just closed, 34,042,897 tons, and the total is 39,486,977 tons; deduct the amount on dock Dec. 1, 9,426,881 tons, and we have 30,060,096 tons as the amount that was forwarded either direct or from dock to furnace yards. It is, of course, understood that the difference between the total output of 42,620,201 tons which was shipped from the Lake Superior mines during 1910, and the receipts of 33,498,455 tons at Lake Erie ports, is ore that went to places other than Lake Erie ports, such as the furnaces at Lake Michigan ports. The accompanying table shows receipts at Lake Erie ports and amounts on dock during six years past.

IRON ORE RECEIPTS AT LAKE ERIE PORTS, GROSS TONS.

	1910.	1909.	1908.	1907.	1906.	1905.
Toledo	1,225,202	1,374,224	680,553	1,314,140	1,423,741	1,006,855
Sandusky	....	11,088	....	83,043	35,847	51,202
Huron	197,951	243,082	213,377	971,430	778,453	825,278
Lorain	2,884,738	2,796,856	2,286,388	2,621,025	2,191,965	1,605,823
Cleveland	6,344,943	6,051,342	4,240,815	6,495,998	6,604,661	5,854,745
Fairport	1,516,434	1,734,277	1,518,961	2,437,649	1,861,498	2,008,621
Ashtabula	9,620,638	8,056,941	3,012,064	7,521,859	6,833,352	6,373,779
Conneaut	6,309,548	7,007,834[1]	4,798,631	5,875,937	5,432,370	5,327,552
Erie	942,592	1,235,057	828,602	2,294,239	1,986,539	2,112,476
Buffalo	4,704,439	5,002,235	2,835,099	5,580,438	4,928,331	3,774,928
Detroit	296,412	159,889	....	....	....	....
Total	34,042,897	33,672,825	20,414,491	35,195,758	32,076,757	28,941,259

IRON ORE ON LAKE ERIE DOCKS, DEC. 1, GROSS TONS.

	1910.	1909.	1908.	1907.	1906.	1905.
Toledo	433,215	332,456	590,925	518,645	281,000	368,024
Sandusky	17,728	39,557	36,079	44,546	17,467	52,977
Huron	375,118	477,333	458,158	415,730	245,499	208,023
Lorain	259,448	407,129	426,274	366,271	336,321	271,695
Cleveland	1,638,795	1,547,142	1,458,392	1,281,335	1,224,606	1,330,619
Fairport	839,970	867,640	835,821	523,981	590,783	759,961
Ashtabula	3,287,816	2,594,359	2,293,531	2,056,820	1,631,312	1,589,951
Conneaut	1,329,997	1,411,002	1,296,675	1,000,774	1,057,424	976,976
Erie	792,011	788,046	730,530	652,219	552,631	564,961
Buffalo	452,783	501,125	315,148	435,407	315,412	315,780
Total	9,426,881	8,965,789	8,441,533	7,385,728	6,252,455	6,438,967

Lake Michigan Receipts

It will be noted from the following figures that during the past few years Lake Michigan has become an ore receiving lake of considerable importance. This, of course, is due to the development of the steel business along the south shore of Lake Michigan and in all likelihood an increasing proportion of ore annually goes to these ports. Following are the figures:

LAKE MICHIGAN IRON ORE RECEIPTS, SEASON 1910.

South Chicago, Ill.	5,080,679
Gary, Ind.	1,775,880
Indiana Harbor, Ind.	287,172
Milwaukee, Wis.	121,446
Elk Rapids, Mich.	60,857
East Jordan, Mich.	37,910
Fruitport, Mich.	37,785
Boyne City, Mich.	50,355
Total	7,452,084

Friction Losses

Some time ago Prof. W. F. M. Goss, dean of the College of Engineering, University of Illinois, made some tests with the Dixon pure flake lubricating graphite on ball bearings. As a result of these tests, Prof. Goss says in part that the following conclusions may be drawn:

"A combination of graphite and lard oil makes up a lubricating mixture which, when applied to ball bearings, will accomplish everything which lard oil alone will do and which at the same time will give a lower frictional resistance of the bearing and permit a large increase in the load which it may be made to carry.

"An oil as light as kerosene, when intermixed with graphite, will be converted into an effective lubricant for ball bearings when operated under light or medium heavy pressure.

"Even so viscous a lubricant as vaseline will better perform a given service in the lubrication of ball bearings when supplemented by small amounts of graphite. The bearings to which the mixture is applied will work with less frictional resistance and will carry a heavier load than when vaseline alone is used.

"The admixture of graphite with either a liquid or viscous lubricant, serves both to reduce the friction and to increase the possible load which a bearing thus lubricated can be made to carry."

The Joseph Dixon Crucible Co., of Jersey City, N. J., has a record of Professor Goss' extensive tests with graphite as a lubricant published in pamphlet form under the title of "A Study in Graphite," which is sent free on request.

Average Lake Freight Rate

There is appended herewith the usual annual summary of freight rates for the season of 1910. As is known, the ore rate was restored to the basis of 1907 by an advance of 5 cents in the carrying charge and a reduction of 5 cents in the unloading charge. The ore rates were 70 cents from the head of the lakes, 65 cents from Marquette, and 55 cents from Escanaba. The coal rate to Lake Michigan was established at 35 cents and the differential of 5 cents which usually exists to Green Bay ports was abolished; that is to say, the flat rate of 35 cents was paid to all the ports. The lumber rate worked out at a trifle less figure than that which obtained in 1909, and the grain rates are considerably less. The opening rate on grain from the head of the lakes was 1 cent, and from Chicago 1¾ cents. In an endeavor to retain the water route from Chicago to Buffalo, vessel owners have had to cut rates severely to meet the all-rail rate made by the railways from Chicago to the seaboard. Following is the summary:

AVERAGE FREIGHT RATE ON IRON ORE PER GROSS TON FROM PORTS NAMED TO OHIO PORTS—TABLE COVERING WILD AND CONTRACT RATES FOR 20 YEARS PAST.

	Escanaba.		Marquette.		Ashland and other ports at the head of Lake Superior.	
	Wild or daily rate.	Contract rate.	Wild or daily rate.	Contract rate.	Wild or daily rate.	Contract rate.
1891	0.84	0.65	1.02	0.90	1.11	1.00
1892	0.74	1.00	0.98	1.15	1.15	1.25
1893	0.56	0.85	0.71	1.00	0.77	1.00
1894	0.46	0.60	0.60	0.80	0.78	0.80
1895	0.73	0.55	0.92	0.75	1.13	0.80
1896	0.52	0.70	0.66	0.95	0.77	1.05
1897	0.45	0.45	0.55	0.65	0.57	0.70
1898	0.51	0.45	0.60	0.60	0.62	0.60
1899	0.95	0.50	1.08	0.60	1.29½	0.60
1900	0.69½	1.00	0.78½	1.10	0.84½	1.25
1901	0.64	0.60	0.79	0.70	0.89	0.80
1902	0.59	0.60	0.66	0.70	0.77	0.75
1903	0.61	0.65	0.72	0.75	0.81	0.85
1904	0.53½	0.55	0.62	0.60	0.70	0.70
1905	0.61	0.60	0.70	0.70	0.77	0.75
1906	0.60	0.60	0.70	0.70	0.7555	0.75
1907	0.60	0.60	0.70	0.70	0.75	0.75
1908	0.50	0.50	0.60	0.60	0.65	0.65
1909	0.52	0.50	0.61	0.60	0.66	0.65
1910	0.55	0.55	0.65	0.65	0.70	0.70

Charge to vessels in 1910 for unloading iron ore was 15 cents per ton. The wooden vessels that required trimming paid an additional charge of about 3 cents per ton for that service.

Average ore rates for the entire period of 20 years: Escanaba, contract 62½ cents, wild 61 cents; Marquette, contract 76 cents, wild 73 cents; Ashland and other ports at the head of Lake Superior, contract 82 cents, wild 81 cents.

Average for past 10 years: Escanaba, contract 57½ cents, wild 57½ cents; Marquette, contract 67 cents, wild 67½ cents; Ashland and other ports at the head of Lake Superior, contract 73½ cents, wild 74½ cents.

Figures for 15 years past average of daily rates for full season; previous to 1895 rates given are highest and lowest of the year.

AVERAGE RATES ON WHEAT PER BUSHEL BY LAKE FROM CHICAGO TO BUFFALO.

Year.	Cents.	Year.	Cents.	Year.	Cents.
1860	9.89	1877	3.72	1894	1.27
1861	11.53	1878	3.07	1895	1.97
1862	10.49	1879	4.74	1896	1.70
1863	7.51	1880	5.75	1897	1.56
1864	9.58	1881	3.44	1898	1.53
1865	9.78	1882	2.50	1899	2.71
1866	12.34	1883	3.41	1900	1.79
1867	6.67	1884	2.18	1901	1.42
1868	7.14	1885	2.02	1902	1.51
1869	6.81	1886	3.68	1903	1.41
1870	5.88	1887	4.13	1904	1.32
1871	7.62	1888	2.56	1905	1.67
1872	11.46	1889	2.51	1906	1.72
1873	7.02	1890	1.96	1907	1.57
1874	4.03	1891	2.38	1908	1.00
1875	3.42	1892	2.38	1909	1.56
1876	2.90	1893	1.66	1910	1.44

Average for 51 years 4.18.

Charges to vessels for shoveling, trimming and tallying weights of grain amounted to $4.12½ per 1.000 bu. in 1910.

AVERAGE LUMBER RATES, DULUTH TO LAKE ERIE PORTS.

Year.	Rate per M.	Year.	Rate per M.
1910	$2.34	1904	$2.54
1909	2.40	1903	2.57
1908	2.61	1902	2.54
1907	2.58	1901	2.66
1906	2.71	1900	2.33
1905	2.45	1899	3.08

AVERAGE DAILY RATES OF FREIGHT ON THE GREAT LAKES.

	1908. Cents.	1909. Cents.	1910. Cents.
Iron ore, Escanaba to Ohio ports, gross tons	50.00	51.73	55.00
Iron ore, head of Lake Superior to Ohio ports, gross ton	65.00	66.41	70.00
Iron ore, Marquette to Ohio ports, gross ton	60.00	61.41	65.00
Wheat, Chicago to Buffalo, bu	1.00	1.5641	1.4485
Wheat, Duluth to Buffalo, bu	1.2299	1.9587	1.3313
Soft coal, Ohio ports to Milwaukee, net ton	40.00	36.75	35.71
Soft coal, Ohio ports to Duluth, net ton	30.00	31.30	31.07
Soft coal, Ohio ports to Portage, net ton	30.00	31.25	30.61
Soft coal, Ohio ports to Manitowoc, net ton	35.00	31.25	35.61
Soft coal, Ohio ports to Sheboygan, net ton	35.00	31.25	35.61
Soft coal, Ohio ports to Green Bay, net ton	35.00	32.35	36.22
Soft coal, Ohio ports to Escanaba, net ton	35.00	31.25	35.31
Hard coal, Buffalo to Milwaukee, net ton	40.00	41.80	41.38
Hard coal, Buffalo to Chicago, net ton	40.00	40.99	40.85
Hard coal, Buffalo to Duluth, net ton	30.00	31.98	31.50
Lumber, head of the lakes to Ohio ports	261.08	240.08	234.59

AVERAGE DAILY FREIGHT RATES 10 YEARS, ENDING WITH 1910.

	Cents.
Iron ore, head of Lake Superior to Ohio ports, gross ton	74½
Iron ore, Marquette to Ohio ports, gross ton	67½
Iron ore, Escanaba to Ohio ports, gross ton	57½
Soft coal, Ohio ports to Milwaukee, net ton	43½
Soft coal, Ohio ports to Duluth, net ton	34
Hard coal, Buffalo to Chicago, net ton	43
Hard coal, Buffalo to Duluth, net ton	33½
Wheat, Chicago to Buffalo, bu	1.46
Wheat, Duluth to Buffalo, bu	1.84½
Lumber, head of the lakes to Ohio ports	254.00

AVERAGE OF DAILY LAKE FREIGHT RATES ON HARD COAL FROM BUFFALO TO CHICAGO, MILWAUKEE AND DULUTH DURING TEN YEARS PAST.

Year.	Chicago. Cents.	Duluth. Cents.
1901	50	38
1902	42	33
1903	48	38
1904	43	34
1905	44	34
1906	46	35
1907	40	31
1908	40	30
1909	41	32
1910	41	31½
Average for 10 years	43	33½

Rate to Milwaukee practically the same as to Chicago.

Hard coal is net tons and is handled without charge to vessel.

AVERAGE OF DAILY RATES ON SOFT COAL FROM OHIO PORTS TO MILWAUKEE, ESCANABA, DULUTH, GREEN BAY AND MANITOWOC.

Year.	Milwaukee. Cents.	Escanaba. Cents.	Duluth. Cents.	Green Bay. Cents.	Manitowoc. Cents.
1901	49	46	38	48½	48
1902	46½	41½	34½	46½	42
1903	50½	45	41½	50½	46
1904	47	40	37	45½	47
1905	46½	41½	33½	42	41½
1906	46	42	35	42	42
1907	40	35	30	35	35
1908	40	35	30	35	35
1909	37	31	31	32	31
1910	35½	35	31	36	35½
Average for 10 years	43½	39	34	41	40

Chicago rate about same as Milwaukee.

Coal of all kinds shipped in net tons and handled without charge to vessel.

LAKE FREIGHT RATES ON WHEAT, DULUTH TO BUFFALO.

Year.	Rate. Cents.	Year.	Rate. Cents.
1910	1.33		
1909	1.96		
1908	1.22		
1907	1.86		
1906	2.19		
1905	2.31	1894	1¼ @ 3
1904	1.81	1893	1¼ @ 3½
1903	1.6	1892	2¼ @ 4
1902	1.9	1891	1¾ @ 9½
1901	2.3	1890	2 @ 5
1900	2.0	1889	2 @ 5
1899	3.6	1888	2 @ 5
1898	1.8	1887	2 @ 8
1897	1.75	1886	3¼ @ 8
1896	2.12		
1895	3.50		

F. H. Osborn & Co.

F. H. Osborn & Co., marine insurance, 134 Monroe street, Chicago, have just sent out to the trade a calendar, the pictorial part of which is a reproduction in colors of Carl Fedeler's painting "After the Storm." The calendars issued by this firm are looked forward to quite eagerly at the beginning of every year because exceptional taste is displayed in the selection of the pictorial element. As a marine canvas there are few better than this celebrated painting of Fedeler's, which shows a ship riding the heavy swells that follow a violent storm.

Vessel Losses During 1910

Vessel losses, that is total losses, during 1910 aggregate nineteen. Of the total of 49 lives lost during the season, 44 are due to two accidents, the sinking of the F. H. Goodyear by collision with the steamer J. B. Wood in Lake Huron, entailing a loss of 16 lives, and the strange foundering of the Pere Marquette 18 in Lake Michigan with a loss of 28 lives. Were it not for these two most unfortunate occurrences, the loss of life on the great lakes would have been limited to five souls. As it is, the loss is light in comparison with former years, 121 having been lost in 1909.

The season has probably been a more satisfactory one to the underwriters than any for some years past, though there were three heavy monetary losses, the Goodyear, Pere Marquette 18 and the splendid new steamer W. C. Moreland, which went ashore on Eagle River Reef, entailing a loss of $400,000 on the hull, about $50,000

on cargo and probably $50,000 additional in wrecking costs.

The strandings during the year were comparatively few, proving more careful navigation on the part of masters. Fire continues to be a fruitful source of vessel loss. Of the 19 total losses, 10 were from this cause. Following is the table of total losses:

VESSELS LOST ON THE GREAT LAKES DURING SEASON OF 1910.

Name of vessel.	Cause.	Where lost.	Carrying capacity Gross tons
		STEAMERS.	
Alaska	Fire	Tobermoray, Lake Huron	600
Goodyear	Collision	Off Point Aux Barques, Lake Huron	6,900
Langham	Fire	Off Keweenaw Point, Lake Superior	3,000
Leland	Fire	Huron, O.	6,000
Lycoming	Fire	Rondeau, Lake Erie	2,400
Mary	Foundered	Lake Michigan	30
Moreland, W. C	Stranded	Eagle River, Lake Superior	12,000
Muskegon	Fire	Harbor of Michigan City, Ind	1,596
New York	Foundered	Lake Huron	2,200
Ottawa	Fire	Cape Vincent, Lake Ontario	......
Sharples, John	Stranded	Galloup Island, Lake Ontario	2,800
Vance, Frank L	Fire	Off Ludington, Lake Michigan	2,400
Wasaga	Fire	Copper Harbor, Lake Superior	3,053
Wiehe, T. R	Fire	Portage Bay, near Escanaba	1,290
		BARGES.	
Whitney, Grace	Collision	Bar Point, Detroit river	505
		CAR FERRIES.	
Ann Arbor No. 1	Fire	Manitowoc, Wis.	1,923
Pere Marquette 18	Foundered	Off Sheboygan, Lake Michigan	5,090
		TUGS.	
Bues, H. F	Foundered	Near Pelee Island, Lake Erie	43
General	Collision	Sault river	231

Commerce of Lake Superior

The statistics of the commerce of Lake Superior as measured by the canals at Sault Ste Marie is now being compiled. Owing to greater draught in the Canadian lock, that canal bore the larger part of the tonnage, both vessel and freight. While 12,927 ships used the American canal, as against 7,972 ships used the Canadian canal, the latter has the advantage in both tonnages. The 12,927 ships had a registered tonnage of 26,506,886, while the 7,972 ships had a registered tonnage of 23,349,137. The freight carried through the Canadian canal was 36,435,557 tons as against 25,927,661 tons carried through the American canal. The total of 62,365,218 tons is the largest in lake history, the nearest being that of the season of 1907, when 58,217,214 tons were carried. The United States canal opened May 5 and closed Dec. 14. The Canadian canal opened April 12 and closed Dec. 15. The accompanying table gives the comparative statement for the seasons of 1909 and 1910.

COMPARATIVE STATEMENT OF LAKE COMMERCE.

Items.	Total traffic for— Season 1910.	Season 1909.	Increase. Amount.	Per cent.
Vessels:				
Steamers, number	17,674	16,463	1,211	7
Sailing, number	1,890	1,787	103	6
Unregistered, number	1,335	954	381	40
Total number	20,899	19,204	1,695	9
Lockages, number	14.569	13,571	998	1
Tonnage:				
Registered, net	49,856,123	46,751,717	3,104,406	7
Freight, short	62,363,218	57,895,149	4,468,069	8
Passengers, number	66,933	59,948	6,985	12
Coal:				
Hard, short tons	1,658,844	1,412,387	246,457	17
Soft, short tons	11,854,883	8,527,639	3,327,244	39
Flour, bbls.	7,576,789	7,094,175	482,614	7
Wheat, bush.	86,259,974	113,253,561	26,993,587	*24
Grain, bush.	39,245,485	46,519,451	7,273,966	*16
Manufactured and pig iron, short tons	444,669	522,281	77,612	*15
Salt, bbls.	528,610	651,091	122,481	*19
Iron ore, short tons	41,603,634	40,014,978	1,588,656	4
Copper, short tons	148,070	127,212	20,858	16
Lumber, M. ft. B. M	603,101	552,380	50,721	9
Building stone, short tons	9,635	1,784	7,851	440
General merchandise, short tons	1,411,549	1,140,344	271,205	24

*Decrease.

Ideal Automatic Pump Governor

An automatic pump governor designed especially for use on fuel oil pumps has been placed on the market by the Ideal Automatic Manufacturing Co., 125 Watts street, New York. The governor is made in two styles, known as F. O. A. and B. It is claimed that style F. O A. installed on a fuel oil pump will maintain a desired nozzle pressure at all times and that it is the only governor with a body of oil in the cylinder, doing away with diaphragm and cup leathers. The oil remains on top of the water or other liquid being pumped and follows the piston in both upward and downward stroke, thereby lubricating the piston and reducing liability of sticking.

Style B is designed for special work on the same lines as style F. O. A. but to secure a greater range of pressure than obtainable with a single spring. This is accomplished by the shifting of a lever which brings the high or low pressure spring into action, as required. It is claimed that in this feature the governor is unique. It is also claimed that with this type in case of accident the governor can be used as a hand stop valve by shifting the lever to an upward position, shutting the steam valve tightly and stopping the pump.

It is also claimed that these devices are being successfully used in hydraulic plants for controlling the presses and doing away with accumulators and in controlling pressure on the step bearings of vertical turbines, the pressures running from 1,200 to 1,500 pounds per square inch.

The Hutchison Rotation Indicator

Co-ordination between pilot house and engine room is of prime importance. For years inventors have endeavored to devise some means whereby the pilot can control the engines as does the man at the wheel of an electric launch, but such apparatus has been found too complicated and more apt to get out of repair at the critical moment than are signals to be misinterpreted. It is, therefore, evident that the next best thing to placing one man in entire control of a boat is some means of indicating, to the pilot or captain, just what the engines are doing in response to definite signals, and to give the engineer some definite points to work to. Such an indicator system need not show how many revolutions per minute the engines are making, but should show direction of rotation, whether ahead or astern, and be calibrated in "stop," "half speed ahead," "full speed ahead," "half speed astern" and "full speed astern," for ordinary work. It is, of course, very valuable to know the exact "revolutions per minute" of engines on large steamers, to facilitate dead reckoning and enable the engineer to operate at point of maximum efficiency as to coal consumption, but for smaller craft, the indications as above outlined should prove adequate.

In addition to the indicator in the

pilot house, there should be a similar one in the engine room. When, say, a signal for "half speed astern" is transmitted to the engine room, the man at the throttle can bring his engine speed up until the pointer of his indicator is resting on "half speed astern." There is no likelihood of a mistake to occur with such an indicating system.

Especially is this valuable when passing through a canal lock. The boat is drifting to the end of the lock when "half speed astern" is given. If this is misinterpreted into "half speed ahead," it may prove impossible to counteract momentum imparted to the boat before the error is discovered. An indicator to show instantly the direction and extent of rotation of the propeller shaft would enable the pilot or captain to discover and rectify the mistake before it is too late.

The masterful manner in which the large ore steamers of the great lakes warp themselves into their docks without the assistance of tugs is a marvel to the salt water navigator. But quite frequently a slip-up occurs in execution of signals or the giving of incorrect signals, which causes more damage than would be the cost of several indicator systems.

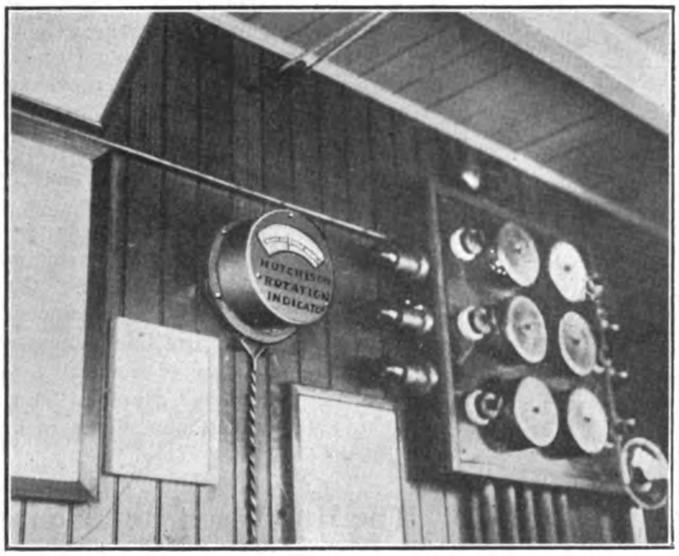
The Hutchison rotation indicator is designed to provide against just such a contingency. It is a modified form of the Hutchison electrical tachometer, which is approved and in use by the United States navy. It is so exceedingly simple it can be installed in a few hours by the engineer, and should last indefinitely. The little electrical generator is attached to a convenient support near the flange coupling aft of the thrust bearing. This coupling is used as a driving pulley.

The little electrical generator is located near and is driven by the propeller shaft, just aft of the thrust bearing. It is mounted on a spring tension base, thereby preventing any slipping of the driving belt. A twisted pair of flexible wires are run from the generator to the engine room indicator, and thence to the pilot house. The entire apparatus is no more difficult to install than an ordinary electric bell.

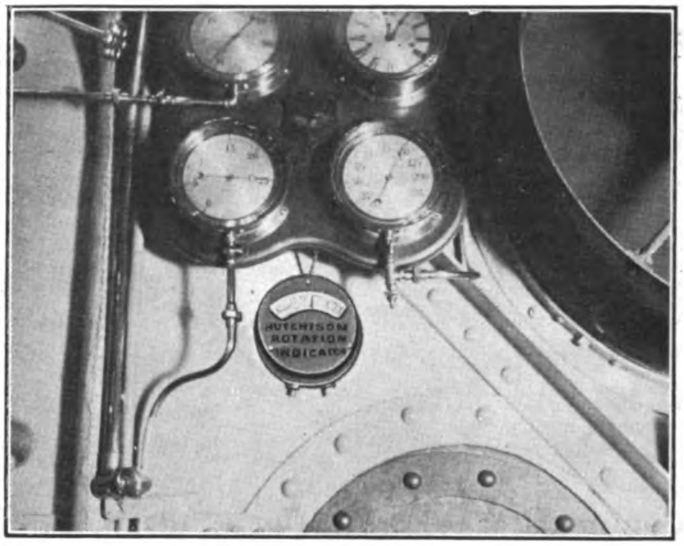
The indicators have a large black pointer that can be seen at considerable distance. The stop or point of no rotation is in the middle of the scale. Deflections of the pointer to the right of the center indicate rotation ahead. To the left of the center, rotation astern. The scale is divided up into half and full speed ahead and astern, or otherwise as may be desired.

About a year ago the Chapman & Derrick Wrecking Co., of New York, installed one of the Hutchison rotation indicators on their new derrick Chancellor. It has continued in uninterrupted and satisfactory operation ever since and the company expects to equip the rest of their boats this winter.

This apparatus is a product of the laboratory of Miller Reese Hutchison, inventor, of New York. The Industrial Instrument Co., of Foxboro, Mass., and having offices of the marine department at 50 Church street, New York, are the manufacturers.



HUTCHISON ROTATION INDICATOR IN PILOT HOUSE OF CHANCELLOR.



HUTCHISON ROTATION INDICATOR IN ENGINE ROOM OF CHANCELLOR.

A New Method of Scaling Vessels

The difficulties that attend the preparing of the surface of steel or iron ships prior to launching, so as to exclude and prevent the corrosive action of the water are numerous. The primary cause of the vexatious problem is the mill scale which forms on the plates during the rolling processes, affording protection to the oxide, the pernicious action of which continues under the scale after preservatives have been applied.

Some prominent engineers have gone so far as to advocate the launching of vessels without having first applied preservatives, in order that the corrosion may eventually work off the mill scale; thereafter trusting to the very imperfect action of steel wire brushes to remove the rust before applying an anti-corrosive. The corrosion of a metal surface once begun, however, must continue until every particle of oxide has been removed. This statement will be fully appreciated by all who have had occasion to examine the pitted hulls of steel and iron craft on and below the water line.

Among the more recent remedies may be named the pneumatic chipping hammer, which has to a certain extent been used instead of hand scaling, in comparison with which its advantage is the greater area of surface covered in a given time, but this appliance fails to remove corrosion from pit holes.

Some 40 years ago the first sand blast machine was put on the market,

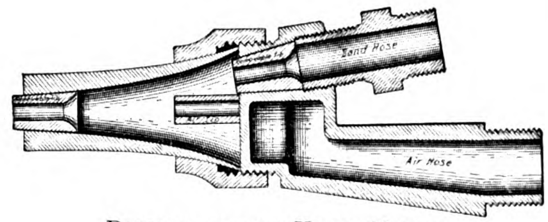


DIAGRAM OF THE KELLY NOZZLE.

and the principle upon which it was operated has since been generally recognized as the best agent for removing mill scale and rust. Its general adoption has failed for two reasons: 1st.—Because of the difficulties of applying the high pressures needed to instantaneously remove incrustations and, 2nd.—Because the air and sand required for the process being delivered through a single line of hose so rapidly enlarges the orifice of the nozzle that an ever-increasing volume of air is consumed, making the cost of power almost prohibitive.

In the Kelly high-pressure sand blast machine, made by the High-Pressure Sand Blast Co., of New York City, these objections have been completely overcome by the adoption of a special type of nozzle and independent lines of hose for sand and the compressed air. This machine is in successful operation for the scaling of ships' bottoms and for a variety of other purposes for which the single-hose devices have hitherto been used with indifferent success.

As will be seen by the accompanying cut of the Kelly nozzle, the sand coming through one orifice at a low velocity is met by the full blast of the air at a pressure of 90/100 lb. per sq. in. at a high velocity. The impact of the combined streams produces a very surprising result, removing the incrustations instantaneously and exposing the natural gray metal. The additional advantages of being able to thoroughly clean around rivet heads and to reach otherwise inaccessible points behind stringers, keelsons, etc., is obvious. The wearing parts of the Kelly nozzle are removable and are of negligible cost.

The yacht Emrose was scaled by the Kelly machine at Messrs. Tietjen & Lang's dry dock in Hoboken, N. J., under the direction of William Gardner, naval architect, by the High Pressure Sand Blast Co. The operation was witnessed with much interest by a number of engineers. The company has received some fine testimonials from users.

Another feature of this machine is its adaptability for scaling interior of marine boilers by the use of a special patented nozzle, into which water is sprayed under pressure to moisten the abrasive and kill the dust, facilitating an operation which, under the most favorable conditions, is a most tedious one.

Essex Non-Destructible Rubber Rug

The Essex Rubber Co., Trenton, N. J., has placed upon the market a perforated rubber mat, which has met with much favor in that it seems to solve the problem of providing a highly ornamental article, as well as one possessing great wearing qualities. Moreover, as the rug can be tightly rolled up and stowed away on end without the slightest injury, it offers many advantages for use on ship board. It is in fact peculiarly well adapted for this purpose, as its decorative possibilities are limitless and it can be made to harmonize with any scheme of color. For steamship passenger gangways, landings and stairways it is a most superior article, as its durability is such that it can withstand the hardest wear. It is quite a commendation that this rug has been adopted by the United States senate, house of representatives and the post office at Washington.

Self-Lubricating Metallic Packing

Fig. 1 is a sectional view of the container form sectional metallic packing manufactured by the New Era Mfg. Co., Kalamazoo, Mich., in which *A* represents the piston rod, *B* the body of stuffing box, *C* the stuffing box gland, *D* the main body of packing-container, *E* the supplementary gland, *F* and *F* the bearing rings, *G* and *G* the studs, *H* and *H* the nuts on studs, *I*, *I*, *I*, the self-lubricating metallic packing, and *J* the metallic rings which surround the rod in three sections, as illustrated in Fig. 2.

Referring to Fig. 1, it will be seen that the supplementary gland *E* fits inside the main body of packing-container *D* and moves forward with the stuffing box gland *C* to compress the packing in the packing-container; thus providing a means to adjust the pressure on the rod, and to compensate the wearing of the plastic self lubricating metallic packing *I*, *I*, *I*.

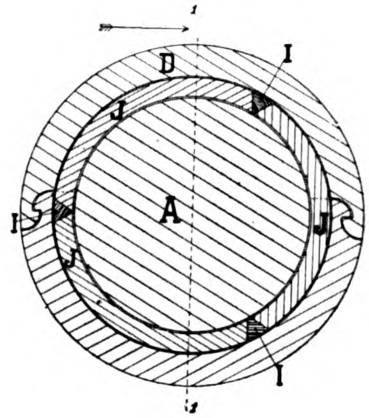


FIG. 2.

The bearing rings *F* and *F* admit of lateral motion to the main body of packing-container *D* and the supplementary gland *E* to compensate out-of-alignment conditions of the piston rod, without interfering with the efficiency of the packing.

The plastic metallic packing *I* and *I*, which is placed behind bearing ring *F* at back end of stuffing box and in front of bearing ring *F* at front end of stuff-

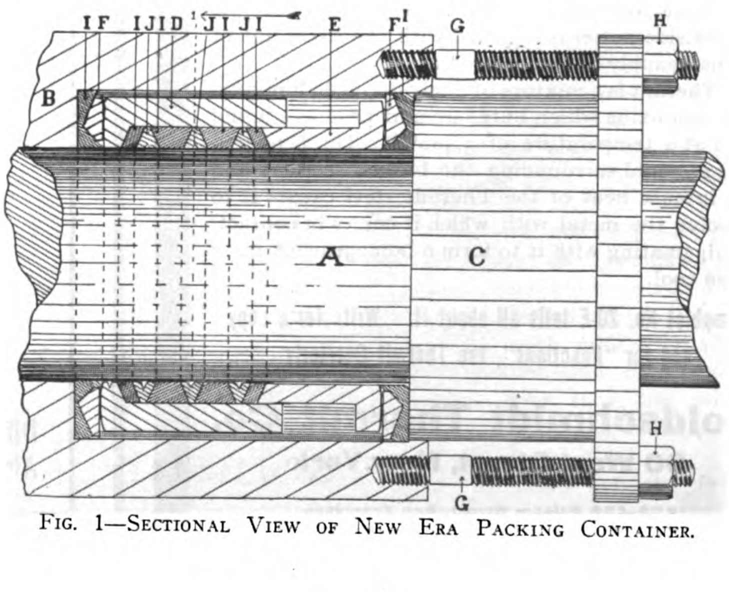


FIG. 1—SECTIONAL VIEW OF NEW ERA PACKING CONTAINER.

ing box, prevent leakage around the outside of packing-container.

The sectional metal packing-rings *J*, *J* and *J*, are forced into close contact with the piston rod, through the agency of the plastic packing *I*, *I*, *I* and *I*.

Referring to Fig. 2, it will be seen that the sectional packing rings, *J*, *J* and *J*, are formed in duplicate, so that when installing the packing any three pieces may be used to form a ring around the piston rod, and are so formed at their ends, as to admit of their automatic adjustment to the conditions of wear, without interfering with efficient service, the space between their ends being occupied by the plastic packing *I*, *I* and *I*.

Fig. 2 also illustrates the manner in which the united portions of the different rings admit of their being installed without detaching the piston rod from its cross head.

It is claimed that New Era packing-containers are permanent fixtures, less subject to wear than the gland on the stuffing box of a piston rod; also that the sectional metal packing rings, if constructed of proper material, will equal the ordinary life of a steam engine. The plastic self lubricating metallic packing, which is installed between the sectional metal packing rings, can be replaced whenever occasion may require; and, under ordinary conditions, years will elapse between such replacements, as this packing consists of a non-elastic, practically imperforate, compound mass of metallic lubricants, which, it is claimed, provides perfect lubrication under all conditions of service, requiring no lubrication whatever, except that contained within its own substance, and will not score the rods or plungers on which it is used.

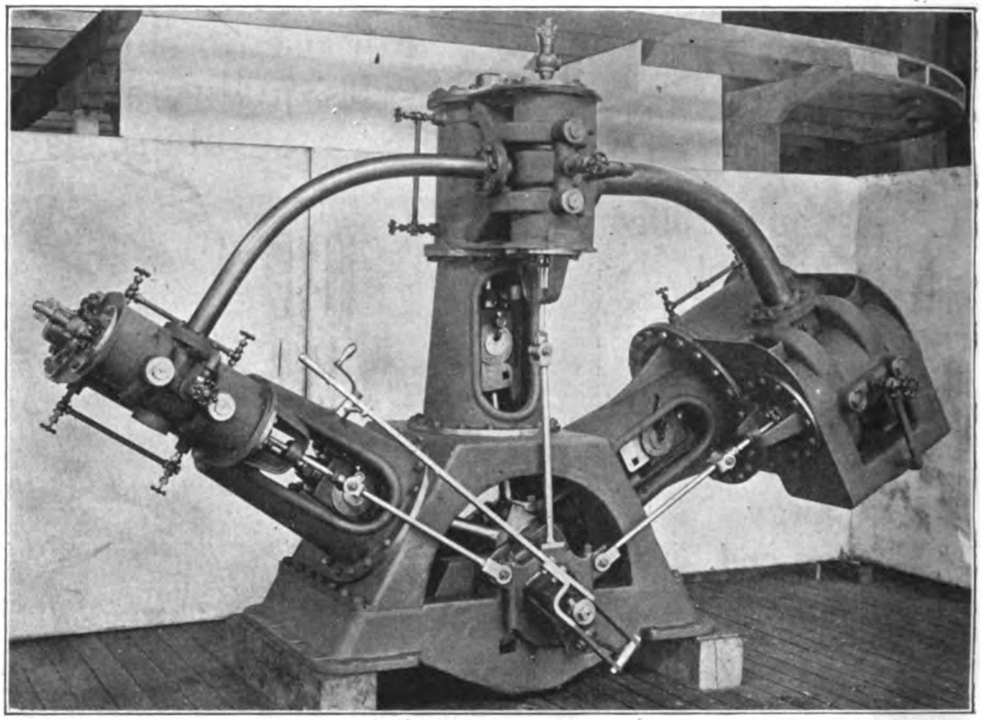
A Simple Marine Engine

The accompanying illustration shows a remarkably simple triple expansion marine engine, particularly well suited for single screw steamers and tugs. The simplicity of the design and the elimination of two cranks, four main bearings, three links, five eccentrics, five straps and three eccentric rods, reduces the maintenance to the minimum, and increases the efficiency by reducing the friction.

The size shown, one of a pair recently completed, has cylinders 9 in., 14½ in. and 25⅝ in. diameter by 14-in. stroke, designed and built for a working steam pressure of 250 lbs. and 300 revolutions per minute. Piston valves on all cylinders are easily operated and reversed by the single eccentric valve gear, which possesses all the advantages, in point of cut-off and handling, that can be obtained with the best link motion.

The connecting rods, eccentric rods and crank shaft are forged from the solid without welds. The pistons and cross-heads are of open-hearth steel castings. The bearings are lined with Parson's white brass, and of ample size to insure perfect running under full power. Forced lubrication to the main bearings and cranks provides for continuous running, the surplus oil being returned to the crank pit and used over and over again. The thrust bearing is of the enclosed type, running in oil against white metal thrust collars.

The Charles Ward Engineering Works, Charleston, W. Va., are building a line of these engines in sizes from 150 to 700 H. P.



SIMPLE DESIGN OF MARINE ENGINE SUITABLE FOR SMALL STEAMERS AND TUGS.

Electric Flash Whistle Signal

Frank Morrison, compass adjuster and manufacturer of nautical and mathematical instruments, 1428 W. Eleventh street, Cleveland, has undertaken the manufacture of the Atlee electric flash whistle signal. This signal, which shows a elongated spar light at each blast of the whistle and of the same duration, was, as previously noted in THE MARINE REVIEW, installed on the steamer Promise in Detroit river service during the last season, and has evoked much favorable comment from vessel masters.

Winter Mooring List of Lake Vessels

ALGONAC, MICH.

Sch. Arenac.	Sch. Moore, W. K.

ALLOUEZ BAY, WIS.

Str. Brown, W. L.	Str. Mitchell, John.

ALPENA, MICH.

Str. Carter, W. J.

ASHLAND, WIS.

Tug Ashland.	Str. Smith, Wilbert L.
Str. Hilton.	Str. Stewart, A. E.
Str. Leonard, Geo. B.	

ASHTABULA, O.

Str. Brown, Harvey H.	Str. Morse, J. C.
Tug Edward, James.	Str. Normania.
Str. Ellwood	Str. Price, Chas. S.
Str. Flagg, Geo. A.	Str. Robbins, F. L.
Str. Grammer, G. J.	Str. Rockefeller.
Str. Gratwick, Wm. H.	Bge. Santiago.
Dge. Majestic.	Str. Saturn.
Str. Malietoa.	Str. Watson, C. W.
Str. Mills, D. O.	Str. Widlar, Francis.

BAY CITY, MICH.

Str. Bradley, C. H.	Sch. Jenness, B. W.
Str. Donaldson, J. P.	Bge. Wright, A. W.
Sch. Goshawk.	Str. Zillah.

BELLEVILLE, ONT.

Sch. Keewatin.

BENTON HARBOR, MICH.

Tug Bonita.	Str. City of Traverse.
Str. City of Benton (Harbor.	Str. Holland.
	Str. Puritan.
Str. City of Chicago.	

BERTHIERVILLE, QUE.

Bge. Dunn, S. H.

BOUCHERVILLE, P. Q.

Str. Boucherville.	Str. Longueuil.

BROCKVILLE, ONT.

Str. Cataract.	Str. Senator Derbyshire.
Str. Marshall, Samuel.	

BUFFALO, N. Y.

Str. Adams, Thomas.	Str. Mohegan.
Str. Admiral.	Str. Noble, Benjamin.
Str. Alaska.	Str. Northern Light.
Bge. Aloha.	Str. Northern Queen.
Str. Americana.	Str. North Land.
Str. Andrews, Matthew.	Str. North Star.

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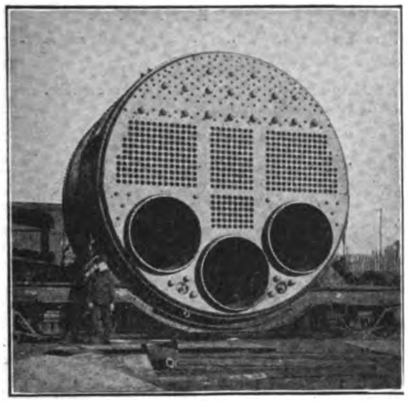

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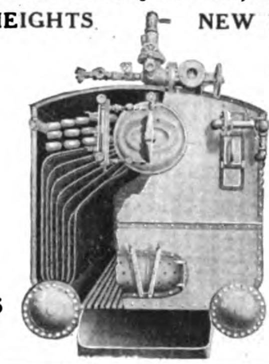

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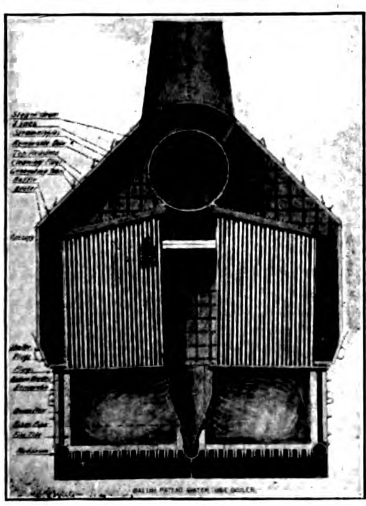

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Str. Cornelius, Adam.
Str. Coulby, Harry.
Str. Craig, Geo. L.
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Str. DeGraff, L. S.
Str. Duluth.
Str. Eddy, Selwyn.
Str. Elba.
Bge. Fassett, S. S.
Str. Gratwick, W. H. (No. 1.
Bge. Holland, N. C.
Str. Holland, Robert.
Str. Huron.
Str. Ireland, R. L.
Str. Jenkins, C. O.
Str. Juniata.
Str. Kopp, Jacob T.
Str. Lake Shore.
Str. Lehigh.
Str. McGean, J. A.
Str. Mauch Chunk.
Str. Maytham, Thomas.
Str. Milinokett.
Str. Miller, P. P.
Str. Mills, Robert.
Str. Mills, Wm. M.
Str. Minneapolis.
Str. North West.
Str. North Wind.
Str. Osborne, F. M.
Str. Ranney, Rufus P.
Sch. Redington, Nellie.
Str. Rhodes, Wm.
Str. Rochester.
Str. St. Paul.
Str. Saranac.
Str. Schuck, R. E.
Str. Schuylkill.
Bge. Scotia.
Str. Seneca.
Str. Sill, H. S.
Str. Smith, L. C.
Str. Smith, Lyman C.
Str. Squire, F. B.
Str. Stadacona.
Str. Starrucca.
Str. Steel King.
Str. Superior.
Str. Syracuse.
Str. Tionesta.
Str. Tomlinson, G. A.
Str. Truesdale, Wm. H.
Str. Underwood, F. D.
Str. Utica.
Str. Walker, P. G.
Str. Walsh, James P.
Str. Warner, Chas. M.
Str. Weeks, J. L.
Str. Weston, Charles.
Str. Wickwire, T. H.
Str. Wickwire, T. H. Jr.
Str. Wilkinson, H. S.
Bge. Wilson, Annabell.
Str. Woodruff, L.
Str. Yale.

BYNG INLET, ONT.

Bge. Francomb, J. A.
Bge. Mingoe.

CARROLLTON, MICH.

Bge. Jackson, G. K.
Str. Langell Boys.

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Str. Burlington.
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Bge. Case, J. I.
Str. Chemung.
Str. Christie, T. S.
Str. City of Genoa.
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Str. City of Paris.
Bge. Connelly Bros.
Sch. Cora A.
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Bge. Delta.
Bge. Fryer, R. L.
Str. Fryer, Robert L.
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Str. Lagonda.
Str. McWilliams, J. J.
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Str. Milwaukee.
Bge. Mitchell, F. W.
Str. Mohawk.
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Str. Mueller.
Str. Niko.
Bge. Norris, A. B.
Str. Nyanza.
Str. Orr, Arthur.
Str. Owego.
Str. Pahlow, Louis.
Str. Peters.
Str. Prentice, J. H.
Sch. Quickstep.
Str. Reis, Wm. E.
Str. Rutland.
St. Bge. Sawyer, (Philetus.
Str. Three Brothers.
Str. Troy.
Str. Tuscarora.
Str. Vail, Walter.
Str. Van Vleck, Geo. H.

CLEVELAND, O.

Bge. Allegheny.
Str. Andaste.
Sch. Anderson, Alex.
Bge. Antrim.
Bge. Athens.
Str. Augustus, A. A.
Bge. Aurora.
Str. Bessemer.
Str. Black.
Bge. Bottsford, R.
Str. Brown, J. J. H.
Str. Cadillac.
Str. Castalia.
Bge. Chattanooga.
Str. Chisholm, Alva (S. Jr.
Str. Choctaw.
Str. City of Buffalo.
Str. City of Erie.
Str. Dalton, H. G.
Str. Eads.
Str. Eastland.
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Str. Ford, J. C.
Str. French, G. Watson.
Str. Frontenac.
Str. Hanna, D. R.
Str. Hiawatha.
Bge. Holley.
Str. Houghton.
Str. Hutchinson, J. T.
Str. Leuty, D.
Str. McGregor, Mary A.
Bge. Magnetic.
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Str. Nye, Harold B.
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Str. Roman.
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Str. Scott, Issac M.
Str. Stone, Amasa.
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Str. Tacoma.
Str. Thompson, A. W.
Str. Tioga.
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Bge. Tyrone.
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Str. Jupiter.
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Str. Collingwood.
Str. Doric.
Str. Germanic.
Str. Leafield.
Str. Majestic.
Str. Meaford.
Str. Soo City.
Str. Turret Chief.
Str. Waubic.
Str. Westmount.

CONNEAUT, O.

Str. Empire City.
Str. Fulton.
Str. Marquette and (Bessemer No. 1.
Str. Mataafa.
Str. Morgan.
Str. Siemens.
Str. Van Hise.

DEPOT HARBOR, ONT.

Str. Kearsarge.
Str. Newona.
Str. Orr, Geo. N.

DETROIT, MICH.

Str. Bielman, C. F. Jr.
Bge. Brian Boru.
Sch. Carrey, M.
Str. Champlain.
Str. City of Alpena.
Str. City of Cleveland.
Str. City of Detroit.
Str. City of Mackinac.
Str. City of St. Ignace.
Str. City of the Straits.
Str. City of Toledo.
Str. Eastern States.
Str. Gettysburg.
Bge. Godfrey, Jeremiah.
Str. Greyhound.
Bge. Handy Andy.
Str. Harvey, Hugh R.
Str. Houghton, Mary.
Str. Houghton, H.
Str. Huron.
Str. Idlewild.
Str. Ionia.
Str. Kirby, Frank E.
Str. McKerchey, J. M.
Sch. McWilliams, Ed.
Str. Owana.
Tug Paddy Miles.
Str. Papoose.
Str. Pine Lake.
Str. Raleigh.
Str. St. Claire.
Tug Shaughraun.
Tug Shaun Rhue.
Tug Sheridan, Phil.
Tug Spalpeen.
Str. State of New York.
Str. State of Ohio.
Str. Tampa.
Str. Tashmoo.
Bge. Tipperrary Bay.
Bge. Tokio.
Str. Toltec.
Str. Victoria.
Str. Wauketa.
Str. Western States.

DULUTH, MINN.

Str. Allegheny.
Str. America.
Str. Ames, Ward.
Str. Boland, John J.
Str. Bope, H. P.
Str. Buffalo.
Str. Caldera.
Str. Calumet.
Str. City of Bangor.
Str. Colonel.
Str. Corrigan, James.
Str. Cuddy, Loftus.
Str. Donaldson, J. A.
Str. Easton.
Tug Ferris, Charley.
Str. Gayley, James.
Str. Gen. Garretson.
Str. Gilchrist, F. W.
Str. Hart, F. W.
Str. Heffelfinger, F. T.
Str. Hoyt, James H.
Str. Kerr, D. G.
Str. Kerr, Wm. B.
Str. Laughlin, James.
Tug Mentor.
Tug Meyer, John E.
Str. Munro, J. G.
Ltr. Mutual.
Str. Norway.
Bge. No. 40.
Bge. No. 1.
Bge. No. 2.
Str. Ohl, E. A.
Str. Olympia.
Str. Peavey, Geo. W.
Str. Penobscot.
Str. Pollock, W. G.
Str. Reed, James H.
Str. Rhodes, J. W.
Str. Sellwood, Joseph.
Str. Senator.
Str. Sherwin, John.
Str. Taylor, Moses.
Str. Thompson, Smith.
Str. Wallace, James C.
Str. Whitney, D. M.
Str. Wissahickon.
Str. Wolf.
Str. Wolvin, August B.

ECORSE, MICH.

Str. Angeline.
Str. Boeckling, G. A.
Str. Ishpeming.
Str. Mather, Wm. G.
Str. Maunaloa.
Str. Michigan.
Str. Palmer.
Str. Presque Isle.
Bge. Sagamore.
Str. Sheadle, J. H.
Str. White, Peter.

ERIE, PA.

Bge. Bell.
Bge. Bryn Mawr.
Bge. Carrington.
Bge. Corliss.
Str. Corona.
Str. Elphicke, M. C.
Bge. Fritz, John.
Str. German.
Bge. Jenney.
Bge. Krupp.
Str. LaSalle.
Bge. Magna.
Str. Mahoning.
Bge. Maia.
Bge. Maida.
Bge. Malta.
Bge. Manda.
Bge. Manila.
Bge. Marcia.
Bge. Marsala.
Bge. Martha.
Str. Matoa.
Str. Muncy.
Str. Neilson.
Str. Nettleton, A. E.
Bge. 137.
Str. Octorara.
Str. Saxon.
Str. Scranton, Walter.
Bge. Smeaton.
Str. Stephenson.
Str. Susquehanna.
Bge. Thomas.
Str. Uganda.

ESCANABA, MICH.

Str. Hemlock.

FAIRPORT, O.

Str. Briton.
Str. Dunn, John Jr.
Str. Maritana.
Str. Wawatam.

FORT WILLIAM, ONT.

Str. Albright, John J.
Str. Dundee.
Str. Dunelm.
Str. Durston, J. F.
Str. Edmonton.
Str. Glenellah.
Str. Mack, Wm. Henry.
Str. Mapleton.
Str. Peavey, Frank H.
Str. Pellatt, H. M.
Str. Wahcondah.
Str. Wexford.

FRUITPORT, MICH.

Str. Pentland.

GREEN BAY, WIS.

Str. Barlum, John J.
Str. Barlum, Thomas.
Str. Brown, Fayette.
Str. Dunham.
Str. Fitzgerald.
Str. Hart, Eugene C.
Str. McVea, Charles.
Str. Western Star.

GODERICH, ONT.

Str. Acadian.
Str. Beaverton.
Str. Fairmount.
Str. Gordon, D. A.
Str. McKee, J. A.
Str. Neebing.
Str. Stormount.

HAMILTON, ONT.

Str. Haddington.
Str. Macassa.
Str. Modjeska.
Str. Plummer, J. H.

HOLLAND, MICH.

Str. Perry, D. P.

HURON, O.

Str. Edwards, Wm.
Bge. Golden Age.

KENORA, ONT.

Str. Agwinde.
Str. Keenora.
Str. Keewatin.

KENOSHA, WIS.

Str. City of Marquette.

KINGSTON, ONT.

Str. Advance.
Str. America.
Str. Bain, Jessie.
Str. Caspian.
Sch. Ferry, Maj. N. H.
Sch. Ford River.
Str. Glenmount.
Str. Hackett, Wm.
Bge. Hamilton.
Str. Holcomb, Ralph T.
Str. Iona.
Sch. Maize.
Sch. Merrill, Julia B.
Str. Navajo.
Str. Nevada.
Str. New Island (Wanderer.
Str. North King.
Str. Ottawa.
Str. Pierrepont.
Bge. Quebec.
Str. Ramona.
Str. Rideau King.
Str. Rideau Queen.
Str. Rosemount.
Str. St. Lawrence.
Str. Seguin.
Str. Sowards.
Bge. Ungava.
Str. Windsor.
Bge. Zapotec.

KINGSVILLE, ONT.

Str. Clark, Alfred.

LACHINE, QUE.

Str. Empress.

LAKE LINDEN, MICH.

Bge. Warriner, S. D.

LEVIS, P. Q.

Str. Tadousac.

LORAIN, O.

Str. Butler, Jos. G. Jr.
Str. Coralia.
Str. Crescent City.
Tug Dempsey, E. S.
Str. Edenborn.
Str. Ericsson.
Str. Hill.
Str. Linn.
Str. Lynch.
Str. Marina.
Str. Mesaba.
Str. Morrow, Jos. S.
Str. Nicholas, I. W.
Str. Olcott.
Str. Princeton.
Str. Ream.
Str. Reiss, John P.
Str. Rensselaer.
Str. Shenango.
Str. Snyder, Wm. P.
Str. Wilpen.

MANISTEE, MICH.

Str. Buckley, Edward
Str. City of S. Haven.
Str. Dewar, John.
Str. Fletcher, F. W.
Str. Marshall, Maggie.
Str. Neff, Sidney O.
Str. Nessen, N. J.
Str. Pere Marquette 6.
Str. Petoskey.
Str. Schroeder, John
Str. Wente, Robert C.
Str. Wotan.

MANITOWOC, WIS.

Str. Australia.
Str. Burnham, George.
Str. Carolina.
Str. Chicago.
Str. Christopher (Columbus.
Str. City of Berlin.
Str. City of Rome.
Str. Elphicke, C. W.
Str. Hanna, H. M. Jr.
Str. Onoko.
Str. Owen, John.
Str. Ralph, P. J.
Str. Sheboygan.
Str. Virginia.
Str. Wright, A. P.

MARINE CITY, MICH.

Str. Canisteo.
Ltr. Chinook.
Bge. Dayton.
Bge. Gawn, Thomas.
Str. Italia.
Str. King, George.
Sch. Lozen, J. B.
Str. McLouth, S. C.
Str. Maine.
Bge. Melvina.
Bge. Pendell, D.
Str. Sicken, M.

Bge. Knapp, F. M.
Str. Langell, Simon.
Str. Linden.
Tug Smith, Annie L.
Bge. Teutonia.
Bge. Uranus.

MARQUETTE, MICH.

Dge. Duluth.
Bge. No. 3.
Bge. No. 4.
Tug Stone, Ella G.

MEAFORD, ONT.

Str. Kinmount.

MENOMINEE, MICH.

Str. Amazon.

MICHIGAN CITY, IND.

Str. Parks, O. E.

MIDLAND, ONT.

Str. Canadian.
Str. Donnacona.
Tug Magnolia.
Str. Midland King.
Str. Midland Prince.
Str. Midland Queen.
Str. Saskatoon.
Str. Scottish Hero.
Str. Strathcona.
Tug Traveler.
Str. Turret Cape.

MILWAUKEE, WIS.

Sch. Barnes, Bertha.
Str. Berry, B. F.
Str. Boyce, Mary H.
Str. Brower, A. G.
Str. Caledonia.
Bge. Chickamauga.
Str. City of Naples.
Str. Colonial.
Str. Corsica.
Str. Cowle, J. B.
Bge. Crete.
Str. Cumberland.
Str. Earling, E. J.
Str. Eddy, C. A.
Str. Gilchrist.
Str. Hand, C. C.
Str. Hecker, F. J.
Str. Hennepin.
Str. Holden, H. S.
Str. Howe, Geo. C.
Str. Kennedy, Hugh.
Str. Kotcher.
Str. Lambert, John.
Str. Lansing.
Str. Lewiston.
Str. Livingstone, Wm.
Str. McIntosh, H. P.
Str. Mack, Wm. S.
Str. Manola.
Str. Marion.
Str. Mars.
Str. Meacham, D. B.
Str. Merida.
Str. Merrimac.
Str. Minch, Anna C.
Str. Mitchell, Samuel.
Str. Neff, Charles S.
Str. Neosho.
Str. Neptune.
Str. Normandie.
Str. Norton, David Z.
Str. Nottingham, Wm.
Str. Oades, John.
Str. Oglebay.
Str. Omaha.
Str. Pueblo.
Str. Rhodes, R. R.
Str. Roumania.
Str. Russel, G. H.
Str. Saunders, E. N.
Str. Smith, B. Lyman.
Str. Smith, Hurlbut W.
Str. Smith, Monroe C.
Str. Stackhouse.
Str. Steinbrenner, Hy.
Str. Topeka.
Str. Tower, C.
Str. Utley, E. H.
Str. Venus.
Str. Vermillion.
Str. Volunteer.
Str. Vulcan.
Str. Wade, J. H.
Str. Wainwright.
Str. Wallace, E. L.
Str. Wallula.
Str. Westcott, J. W.
Str. Whitaker, Byron.
Str. Wood, J. B.
Str. Wood, Joseph.

MONTREAL, QUE.

Str. Corunna.
Tug Gilbert.
Str. Glengarry.
Str. Princess.
Bge. Warmington, G. H.

MUSKEGON, MICH.

Sch. Davis, Lyman M.
Str. Markham, Geo. C.

NORTH TONAWANDA, N. Y.

Sch. Brightie.
Str. Canadiana.
Str. Clyde.
Str. Curtis.
Sch. Delaware.
Str. Eddy, J. F.
Bge. Filer, D. L.
Str. Fleetwood.
Sch. Genoa.
Str. Green, C. H.
Bge. Moravia.
Str. Myron.
Bge. No. 118.
Bge. No. 130.
Bge. No. 131.
Bge. No. 133.
Str. Oceanica.
Sch. Our Son.
Str. Oscoda.
Str. Packer.
Sch. Page, M. W.
Bge. Pennington.
Sch. Peshtigo.
Bge. Redfern, C. E.
Str. Sawyer, W. H.
Bge. Tuxbury, A. C.
Str. Veronica.
Sch. Woolson, Mary.

OGDENSBURG, N. Y.

Str. Arlington.
Str. Averell.
Str. Brandon.
Str. Crerar, John.
Str. Davidson, A. D.
Str. Hall, H. B.
Str. Haskell.
Str. Hecla.
Str. Langdon.
Bge. Lyon, Mary.
Bge. Matthews, Jennie.
Str. Meade, Spencer.
Str. Mercur, Fred.
Bge. Middlesex.
Str. Morley, W. B.
Str. Nipigon.
Str. Ogdensburg.
Str. Parent, S. N.
Str. Phenix.
Str. Rescue.
Str. Rochester.
Str. Rugee.
Str. Sage, Russell.
Bge. Sherman.
Str. Wallace.

OSWEGO, N. Y.

Bge. Georger, F. A.
Bge. Katie H.
Str. Marshall.

OTTAWA, ONT.

Str. Duchess of York.
Str. Hall.
Str. Hebron.
Str. Ottawan.
Str. Roberval.
Str. Scotsman.

OWEN SOUND, ONT.

Sch. Abyssinia.
Str. Algonquin.
Str. Assiniboia.
Str. Athabasca.
Str. Keewatin.
Str. Manitoba.
Str. Manitou.
Str. Matthews, W. D.

PENETANGUISHENE, ONT.

Bge. Chamberlain, C. W.
Tug Wahnapitae.

PICTON, ONT.

Str. Aberdeen.
Str. Aletha.
Str. Alexandria.
Str. Brockville.
Str. Porter.
Bge. Reid, Isabel.
Bge. Rob Roy.
Str. Water Lily.

POINT EDWARD, ONT.

Str. Crowe, G. R.
Sch. Sephie.
Sch. Tolmie.
Str. Winona.

PORTAGE, MICH.

Str. Hanna, M. A.

PORT ARTHUR, ONT.

Str. Keefe, James.
Str. McKinstry, A. E.
Str. Niagara.
Str. Regina.
Str. Tagona.
Str. Van Allen, D. R.

PORT CREDIT, ONT.

Bge. Muir, A. W.
Tug Roy Mac.

PORT DALHOUSIE, ONT.

Str. Dundurn.
Str. Garden City.
Str. Lakeside.

PORT HOPE, ONT.

Sch. Mowat, Oliver.

PORT HURON, MICH.

Str. Britannic.
Str. Groh, Mary.
Ltr. Howland, Thomas.
Str. Lakeland.
Str. Lake Michigan.
Str. Miami.
Str. Ross, M. M.
Str. Smit, Joseph C.
Str. Yates, Harry.

PORT STANLEY, ONT.

Str. Empress of (Midland.

PRESCOTT, ONT.

Str. Armstrong, Wm.
Str. City of Belleville.
Str. Miss Vandenberg.

PUT-IN-BAY, O.

Str. Tourist.

QUEBEC, P. Q.

Bge. A. D.
Str. Carleton.
Bge. Diamond.
Bge. Edna.
Bge. Ewen, Frank D.
Str. Florence.
Bge. Gladys H.
Str. Hackett, J. H.
Bge. Klondyke.

RIVER ROUGE, MICH.

Str. Morrell, D. J.
Str. Townsend, E. Y.

ST. CLAIR, MICH.

Bge. Iron Cliff.
St. Bge. Maud.
Str. Starke, C. H.
Bge. Young, Wm. A.

ST. IGNACE, MICH.

Str. Algomah.
Str. City of Cheboygan.
Str. St. Ignace.
Str. Wau-Kon.

SAGINAW, MICH.

Bge. Cahoon, T. H.
Bge. Exile.
Str. Flora.
Str. Warren, Homer.
Bge. White & Friant.

SANDUSKY, O.

Str. Arrow.
Str. Clinton.
Str. Columbus.
Bge. Cutler, D. G.
Str. Gowan, A. Y.
Str. Hayes, R. B.
Str. Lakeside.
Sand Str. Mary H.
Bge. Moran, David.
Str. Recor, E. P.
Str. Stephenson, S. M.
Str. Wehrle, A. Jr.

SANDWICH, ONT.

Str. Harper, John.

SARNIA, ONT.

Str. Ames, A. E.
Str. Bielman, C. F.
Sch. Cataract.
Sch. Corisande.
Str. Hamonic.
Str. Huronic.
Str. Imperial.
Str. Impoco.
Str. Ionic.
Str. Ketcham, John (B. 2nd.
Bge. McLachlan, (Mary E.
Str. Osler, E. B.
Str. Saronic.
Str. Turret Court.
Str. Winona.
Bge. 41.

SAUGATUCK, MICH.

Str. Arundell.
Str. Liberty.
Str. Tennessee.

SAULT STE. MARIE, MICH.

Str. Gilchrist, J. C.
Tug Hassayampa.
Dge. No. 2.
Dge. No. 3.
Str. Ontario.

SAULT STE. MARIE, ONT.

Str. Agawa.
Bge. Barlum, John J.
Str. Caribou.
Str. City of Windsor.
Tug Commodore.
Str. Drummond, T. J.
Tug Emerson, George.
Tug Hall, Jessie.
Str. Moore, C. W.
Str. Paliki.
Tug Reliance.
Bge. Thompson, A. W.

SAWYER, WIS.

Bge. Butman.
Bge. Carpenter.
Tug Torrent.

SHEBOYGAN, WIS.

Str. America.
Str. Brazil.
Bge. Chipman, Susie.
Str. Christopher.
Str. Clement, S. M.
Str. Jones, B. F.
Str. Minch, Philip.

SOMBRA, ONT.

Str. Martin, S. K.

SOREL, QUE.

Str. Beaupre.
Str. Belleville.
Str. Berthier.
Str. Cornwall.
Str. Montreal.
Str. Murray Bay.
Str. Quebec.
Str. Rapids Prince.
Str. Rapids Queen.
Str. St. Irenee.
Str. Terrebonne.
Str. Three Rivers.

SOUTH CHICAGO, ILL.

Str. Baker.
Str. Buffington.
Str. Bunsen.
Str. Chili.
Str. Cole.
Str. Corey.
Str. Cornell.
Str. Dinkey.
Str. Gary.
Str. Gates.
Str. Harvard.
Str. Hubbard, Charles.
Str. Hutchinson, C. L.
Str. Joliet.
Str. McDougall.
Str. Maruba.
Str. Morgan Jr.
Str. Murphy.
Str. Odanah.
Str. Ontario.
Str. Paine, Wm. A.
Str. Peck, E. M.
Str. Perkins.
Str. Phipps.
Str. Poe.
Str. Queen City.
Bge. Roebling.
Str. St. Clair.
Str. Schiller.
Str. Shaughnessy.
Str. Stanton, John.
Str. Sullivan, J. J.
Str. Watt.
Str. Widener.
Str. Wilkesbarre.
Str. Williams, George.
Str. Zimmerman, E.

SOUTH HAVEN, MICH.

Str. City of Kalamazoo.
Str. Glenn.

SPRING LAKE, MICH.

Str. Walsh, Lizzie.

STURGEON BAY, WIS.

Scow Advance.
Scow Andrews.
Bge. Corning, Ida.
Scow Dohearty.
Str. Foster, J. N.
Scow Glasgow.
Tug Hunsader, John.
Scow Hurd, Joseph L.
Bge. Oak Leaf.
Scow Pewaukee.
Tug Wheeler, Irma L.

SUPERIOR, WIS.

Str. Ashley, J. S.
Str. Davock, Wm. B.
Str. England, R. W.
Str. Hanna, L. C.
Str. Miller, Leonard B.
Str. Northern King.
Str. Northern Wave.
Str. North Lake.
Str. North Sea.
Str. Waldo, L. C.
Str. Wells, Fred. B.

THOROLD, ONT.

Str. Empress of Fort (William.
Str. Iroquois.
Str. Neepawah.
Str. Rosedale.

TOLEDO, O.

Str. Adriatic.
Sch. Barnes, C. C.
Str. Brokate.
Str. Brown, W. W.
Str. Centurion.
Str. Cherokee.
Sch. Chippewa.
Str. City of Mt. (Clemens.
Str. Clarke, E. A. S.
Str. Colgate.
Str. Commerce.
Bge. Constitution.
Str. Cort.
Str. Denmark.
Str. Dickson.
Bge. Donaldson.
Str. DoVille, R. E.
Str. Dussault.
Str. Ella G.
Str. Fairbairn.
Str. Frick.
Str. Griffin.
Str. Hayward, A. D.
Str. Laura D.
Str. Mariposa.
Str. Morse.
Str. Pope, E. C.
Str. Republic.
Str. Rogers.
Str. Shaw.
Str. Verona.
Str. Victory.
Str. Walter D.
Str. White, Pendennis.

TONAWANDA, N. Y.

Sch. Edwards, J. R.
Str. Farwell, Jesse H.
Str. Kongo.
Str. Niagara.
Sch. Orton, M. E.
Str. Pawnee.
Str. Stafford, W. R.

WASHBURN, WIS.

Str. Upson, Andrew S.

WIARTON, ONT.

Tug Crawford.
Sch. Herschel.
Sch. Sands, Isabella.
Str. Scott, Thomas R.